

**KNOWLEDGE AND ADOPTION OF PANCHSUTRI
TECHNOLOGY IN RABI SORGHUM**

A Thesis submitted to the

**MAHATMA PHULE KRISHI VIDYAPEETH
RAHURI - 413 722, DIST.AHMEDNAGAR
MAHARASHTRA, INDIA**

in partial fulfillment of the requirements for the degree

of

MASTER OF SCIENCE (AGRICULTURE)

in

AGRICULTURAL EXTENSION

by

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MAHARASHTRA, INDIA

2016

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CANDIDATE'S DECLARATION

*I hereby declare that this thesis or part
there of has not been submitted
by me or other person to any
other University or Institute
for a Degree or
Diploma*

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Dated : / /2016

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C E R T I F I C A T E

This is to certify that the thesis entitled, **“KNOWLEDGE AND ADOPTION OF PANCHSUTRI TECHNOLOGY IN RABI SORGHUM”** submitted to the Faculty of Agriculture, Mahatma Phule Krishi Vidyapeeth, Rahuri, Dist. Ahmednagar, Maharashtra (India), in partial fulfillment of the requirements for the degree of **MASTER OF SCIENCE (AGRICULTURE) in AGRICULTURAL EXTENSION**, embodies of results of piece of bonafide research work carried out by **MR. CHAVAN PRASAD SHIVAJI**, under my guidance and supervision and that no part of the thesis has been submitted to any other University for degree or diploma.

The assistance and help received during the course of this investigation have been acknowledged.

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Dated : / /2016

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Dated : / /2016

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Place : MPKV, Rahuri

(P. S. Chavan)

Date : /08 /2016

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LIST OF ABBREVIATIONS

%	: Percentage
Agri.	: Agriculture
Dr. BSKKV	: Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth
Dr. PDKV	: Dr. Panjabrao Deshmukh Krishi Vidyapeeth
Dr. VNMKV	: Dr. Vasant Rao Naik Marathwada Krishi Vidyapeeth
<i>et al.</i>	: Et alia (and others)
<i>etc.</i>	: Et cetera (and so forth)
Fig.	: Figure
Freq.	: Frequency
ha.	: Hectare
i.e.	: That is
ICRISAT	: International Crops Research Institute for the Semi-Arid Tropics
J.	: Journal
KVK	: Krishi Vigyan Kendra
MPKV	: Mahatma Phule Krishi Vidyapeeth
PGI	: Post Graduate Institute
SAU	: State Agriculture University
Sr. No.	: Serial number
Viz.	: Videlicet (namely)

ABSTRACT

**KNOWLEDGE AND ADOPTION OF PANCHSUTRI
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By

CHAVAN PRASAD SHIVAJI

(Reg. No. 14/189)

A candidate for the degree of

MASTER OF SCIENCE (AGRICULTURE)

In

AGRICULTURAL EXTENSIONMahatma Phule Krishi Vidyapeeth,
Rahuri-413 722

2016

Research Guide	:	Dr. S.D. Patil
Department	:	Extension Education

Improved or recommended agriculture practices are the product of modern science and technology. Development of new technology is generally not major problem in our country. The main problem exist today is that acceptance of these technologies by the farmer. Jowar is important crop grown in rabi season. It is short duration crop gives better income within short period hence preferred by most of the farmer. But due to uneven nature of rainfall the yield level of jowar crop is not satisfactory. Even though the improved technologies like *Panchsutri* technology are available with farmer. This is because of the lack of scientific knowledge of farmers to accept the new technology. After considering the importance of *Panchsutri* technology, the present research study entitled, "Knowledge and adoption of *Panchsutri* technology in *rabi* sorghum" was carried out with the objectives: to study the personal, socio-economic characteristics of the sorghum growers, to study the knowledge of the sorghum growers about *Panchsutri* technology for *rabi* sorghum, to study the adoption of *rabi* sorghum *Panchsutri* technology by the sorghum growers, to find out relationship between personal, socio-economic characteristics of sorghum growers with their knowledge and adoption of *rabi* sorghum *Panchsutri* technology and to study the constraints faced

by the sorghum growers in adoption of *rabi* sorghum *Panchsutri* technology and obtain their suggestions for overcoming the constraints.

The data collected from 120 representative farmers from Solapur district. Collected data was processed and analyzed by using frequency, percentage, mean, standard deviation and coefficient of correlation.

The findings of the study showed that, majority of the respondents belonged to middle age group, most of them educated up to primary and secondary school level and most of them had medium level of social participation. Majority of the respondents had moderate farming experience, most of them had medium level of annual income, nearly one half of the respondents had small size of land holding, majority of the respondents belongs to group having medium level of sources of information.

Overall knowledge level showed that, more than half of respondents had medium level of knowledge, followed by high level of knowledge and low level of knowledge. Overall adoption level showed that, more than half of respondents had medium level of adoption, followed by low level of adoption and high level of adoption.

Knowledge of the respondents about *Panchsutri* technology was increased with the increased level of education, social participation, annual income, land holding and information sources use because there was a positive and highly significant relationship in these and knowledge. The age and farming experience showed a negative but highly significant relationship with knowledge of the respondents.

Adoption of the respondents about *Panchsutri* technology was increased with the increased level of education, social participation, annual income, land holding and information sources use because there was a positive and highly significant relationship in these and adoption. The age and farming experience showed a negative but highly significant relationship with adoption of the respondents.

The important constraints reported by majority respondents were, unavailability of water for irrigation, lack of information about use of pesticides, lack of knowledge about mulching.

Other constraints reported by the farmers were lack of knowledge of use of fungicide, unavailability of *Sara yantra* for preparation of beds, lack of availability of quality seeds within time, lack of knowledge of seed treatment, lack of knowledge about improved tools and implements, difficulty in protection of grains from birds, high cost of fertilizers and unavailability of labour at low cost.

Respondents had made various suggestions to overcome the constraints, the suggestions were, protective irrigation facility should be made available. Agriculture department, SAU's and KVK's should provide knowledge about use of pesticides, government should provide loan and subsidies in time, Training programmes on *Panchsutri* technology should be conducted, Pre seasonal training and crop demonstrations programme should be organized by Agriculture department, there should be availability of quality seeds in nearby *Krishi Vigyan Kendra* and *Krishi Seva Kendra*. Other suggestions were, supply of 'Agni ribbon' by Agriculture department for protection of grains from birds, the cost of seeds, fertilizers and pesticide should be reduced, Custom hiring facility should be made available at village level .

CHAPTER I

INTRODUCTION

Sorghum (*Sorghum bicolor* (L.) Moench) popularly known as *Jowar* is the most important food and fodder crop of dry land agriculture. The crop is primarily grown in Maharashtra and southern states of Karnataka and Andhra Pradesh. These three states together account for close to 80.00 per cent of the all-India production.

Sorghum is the fifth most important cereal crop in the world after wheat, rice, maize and barley. It is found in the arid and semi arid parts of the world, due to its feature of being extremely drought tolerant. Sorghum is also used for ethanol production, producing grain alcohol, starch production, production of adhesives and papers other than being used as food and feed.

Over 55.00 per cent of grain produced globally is used for human consumption in the form of flat breads and popularly known in India as “*Bhakri*”. The nutritional value of sorghum is same as of that of corn and that is why it is gaining importance as livestock feed also. Sorghum grain contains about 10-12 per cent proteins, 3.00 per cent fat and 70.00 per cent carbohydrates. Therefore, it can satisfactorily replace other grains in feeding programme for dairy cattle, poultry.

It is quite soft, palatable and fast growing annual fodder crop adapted to areas up to 1500 m altitude. Under irrigated conditions two crops of sorghum may be taken in one year, one during the month March to June (i.e. Summer) and the second during regular monsoon season in the month from June to

October (i.e. Kharif). In Maharashtra, jowar can be grown in *kharif*, *rabi* as well as in summer seasons.

1.1 Present Scenario

Maharashtra is one of the leading state in India for kharif and rabi sorghum. The Maharashtra had total 22.97 lakh hectares area under sorghum during 2014-15 out of which 4.53 and 18.44 lakh ha. area is grown in kharif and rabi with an average per hectare yield of 909 and 702 kg per hectares, respectively.

Western Maharashtra is having 14.39 lakh hectares area under sorghum cultivation, out of which 1.81 lakh hectares area is under kharif and 12.58 lakh hectares in rabi season. The production of kharif and rabi are 2.60 and 10.46 lakh tones, respectively during the year 2014-15. The productivity of kharif and rabi in the western Maharashtra is 1436 kg per ha. and 831 kg per ha. respectively. (Anonymous, 2014 A.)

In case of *rabi* sorghum, a significant increase in productivity could not be achieved due to the biological and environmental limitations. Major constraints for low yield of rabi sorghum are variations in soil types (23.00 per cent shallow, 48.00 per cent medium and 29.00 per cent deep soil), variation in rainfall, susceptibility to low temperature and climate change.

Considering the large area under rabi sorghum in MPKV jurisdiction and the constraints in production and productivity of rabi sorghum the All India Coordinated Sorghum Improvement Project, MPKV, Rahuri developed *Panchsutri* sorghum production technology i.e. Five point Production technology to increase the yield of sorghum under dry land condition.

Table 1. District-wise area, production and productivity of Sorghum in Maharashtra during year 2014-15.

District	<i>Kharif Jowar</i>			<i>Rabi Jowar</i>		
	Area 00/ha	Production 00 tones	Productivity Kg/ha	Area 00/ha	Production 00 tones	Productivity Kg/ha
Nasik	9	20	2100	50	38	758
Dhule	184	201	1095	107	134	1253
Nandurbar	305	262	1184	142	101	710
Jalgaon	525	1113	2120	293	354	1209
Nasik Div.	1023	1695	1657	592	627	1059
Ahmednagar	0	0	0	3681	2773	715
Pune	8	4	515	1192	1107	929
Solapur	3	1	408	3849	3198	831
Pune Div.	11	5	486	8921	7077	793
Satara	239	311	1301	1433	1149	802
Sangli	492	517	1051	1488	1332	895
Kolhapur	43	72	1677	155	271	1750
Kolhapur Div.	774	900	1163	3076	2752	895
Aurangabad	25	11	452	470	179	380
Jalna	11	3	255	938	363	387
Beed	169	83	492	1561	663	425
Aurangabad Div.	204	97	475	2969	1205	406
Latur	420	294	701	225	106	470
Osmanabad	215	56	262	1507	632	420
Nanded	573	210	366	1444	83	573
Parbhani	160	63	397	589	208	353
Hingoli	141	58	411	126	94	750
Latur Div.	1508	682	452	2591	1123	433
Buldhana	206	199	968	155	110	711
Akola	125	153	1227	0	0	0
Washim	100	73	732	11	4	400
Amarawati	149	127	852	0	0	0
Yavatmal	298	119	398	36	15	413
Amravati Div.	878	672	765	202	129	641
Wardha	59	25	424	6	0	0
Nagpur	43	28	656	10	4	420
Chandrapur	30	16	532	33	11	350
Nagpur Div.	132	69	524	87	29	336
State Total	4531	4120	909	18438	12943	702

(Reference : Anonymous, 2014 A.)

1.2 *Panchsutri* Technology

ICRISAT's Harnessing Opportunities for Productivity Enhancement (HOPE) project of Sorghum and Millets in South Asia seeks to help small holder farmers to increase the yields of the two dry land cereal crops i.e. sorghum and bajara in India (Rajasthan, Haryana, Gujarat, and Maharashtra).

HOPE project started and run by International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) in close partnership with Mahatma Phule Krishi Vidyapeeth (MPKV), and the National Directorate of Sorghum Research in the year 2009. The HOPE project of *rabi* sorghum is being implemented in three districts viz.; Solapur, Ahmednagar and Pune of the MPKV jurisdiction as the area under *rabi* sorghum is more concentrated in these districts.

To enhance the production and productivity of *rabi* sorghum the five point production technology (*Panchsutri*) is recommended under this HOPE project.

‘*Panchsutri*’ technology (Five Point Production Technology)

1. Soil moisture conservation practices before sowing.
2. Use of improved varieties as per the soil types.
3. Soil moisture conservation practices after sowing.
4. Nutrient management.
5. Plant protection.

1. Soil moisture conservation practices before sowing

It involves making squares of 10 x 10 m or rectangular compartment on the field to retain the rain water and to arrest soil erosion. After receipt of rains in the month of July-August, land is harrowed to remove the germinated weed. Bunds are retained till sowing of *rabi* crop during the 15th September to 15th October. Compartmental bunds provides more opportunity time

for water to infiltrate into the soil and help in conserving the soil moisture. By this technology the yield is increased up to 30.00 per cent.

2. Use of varieties as per the soil types

The MPKV has developed and recommended different high yielding varieties of *rabi* sorghum as per the soil type and irrigation requirement.

Table 2. The varieties of *rabi* sorghum developed and recommended by MPKV.

Soil Type	Area of adaptation	Hybrids	Varieties
Deep soil	Rainfed areas	CSH 15R CSH 19R	Phule Vasudha, Phule Yashoda, CSV 22
Medium soil	Rainfed areas	-	Phule Suchitra, Phule Chitra, Phule Maulee, M 35-1
Shallow soil	Rainfed areas	-	Phule Anuradha, Phule Maulee, Selection 3
Medium-Deep soil	Irrigated areas	-	Phule Revati, Phule Vasudha, CSV 18
Medium-Deep soil	Rainfed areas	-	Hurda purpose : Phule Uttara Popping purpose: Phule Panchami

By the use of varieties as per the soil types the yield is increased up to 25.00 per cent.

3. Soil moisture conservation practices after sowing

To conserve the soil moisture thinning of crop should be done at 15 to 20 days after sowing. Diseased and pest affected, stunted and weak plants should be removed and only one healthy plant should be allowed to grow per hill after thinning. The optimum plant population should be maintained up to 1,48,000. Three hoeing at 3, 5 and 8 weeks after sowing should be done for sufficient aeration, control weeds and conserve soil moisture by providing top soil mulch. If possible, as per the intensity of the weed two or three hand weeding should be advised. By this technology the yield is increased up to 20 per cent.

When sufficient water is available, schedule of the irrigation should be given during critical growth stages of crop as below.

Table 3. Irrigation requirement of rabi sorghum

Sr.No.	Critical growth stages	Period (Days after sowing)
1	Flower primordial initiation	28 to 30
2	Boot stage	50 to 55
3	Flowering stage	70 to 75
4	Grain filling and development stage	90 to 95

If water available for one irrigation, then irrigation should be given at flower primordial initiation or boot stage depending upon the quantum of available soil moisture in soil. If water available for two irrigation, then first irrigation should be given at flower primordial initiation and second irrigation at boot stage.

4. Nutrient management

Application of 60:30:00 and 40:20:00 kg/ha N, P, K for deep soil and medium soil respectively for rainfed crop is recommended and for irrigated crop 100:50:50 and 80:40:40 kg/ha. N, P, K Fertilizers should be applied. By this technology the yield is increased up to 15.00 per cent.

5. Plant protection

By application of plant protection measures the yield is increased by 10.00 per cent. Seed treatment should be done before sowing i.e 14 ml Imidacloprid (Goucho) + 2gm Carbendanzim (Bavistin) for 1 kg seed or Thiomethaxam (Crusher) 3 gm per kg seed against shoot fly pest and Sulphur treatment @ 4 gm per kg seed and 25 gm Azotobactor per kg against grain and loose smut.

Shoot fly

To control the shoot fly attack seed should be treated with Thiomethaxam (Crusher) 3 gm per kg seed.

Shoot fly can also be controlled by spraying the crop with quinalphos 35 EC 350ml in 250 lit water /ha at 7-8 days after sowing. The second spray of quinalphos 35 EC 700ml in 500 ml water 10 days after first spray should be given.

Stem borer

Stem borer can be controlled by spraying the crop with quinalphos 35 EC 1075 ml in 750 ml water/ha at 30 days after germination.

Chikta

Chikta disease can be controlled by spraying the Diamethoate 30 EC of Methyldematon 25 EC 500ml in 400 liters of water per ha.

Charcoal rot

The mulching of trash or farm waste @ 5 tonn/ha is used if possible to control the Charcoal rot.

Besides this *Panchsutri* technology the MPKV also recommended the package of practices for rabi sorghum cultivation as below,

Table 4. Package of practices for rabi sorghum recommended by MPKV, Rahuri.

Sr. No.	Practices	Recommendations
1	Ploughing	1 ploughing with turning plough 30-45 cm deep
2	Harrowing	2 to 3 harrowings
3	Contour cultivation	Bunding at slope in August
4	Preparation of bed	Bed of 10 x 10 sq. m.
5	Improved Variety as per the soil type	Light soil : Phule Mauli, Phule Anuradha Medium soil: Phule Chitra, Maldandi-35-1, Heavy soil : Phule Vasudha , Phule Yashoda
6	Sowing time	15 September to 15 October
7	Seed and seed treatment	Sulphur 3 gm + 25 gm Azotobactor per kg seed
8	Spacing	45 x 15 cm
9	Thinning	12 to 15 days after sowing
10	Seed rate	10 kg per ha
11	Mulching	Before 45 days of sowing
12	Hoeing	First- 3 weeks after sowing Second - 5 weeks after sowing Third- 8 weeks after sowing
13	Weeding	1 to 2 weeding after 40 days of sowing
14	FYM / Compost	10 cartload per ha

Sr. No.	Practices	Recommendations
15	Chemical fertilizers	For rainfed crop : Light soil :25 kg N/ha Medium soil: 40 kg N/ha, 20 kg N/ha Heavy soil: 60 kg N/ha, 30kg N/ha For irrigated crop: Medium soil:80 kg N/ha, 40 kg P/ha, 50 kg K/ha Heavy soil: 100 kg N/ha, 50kg P/ha, 50kg K/ha
16	Insecticide	Neem extract 5 per cent in 10 liter water, Quinalphos 35 EC 350ml in 250 lit water /ha , Thiomethaxam 3 gm/kg seed
17	Fungicide/herbicide	Sulphur treatment @ 4 gm per kg seed+ 25 gm Azatobacter per kg seed, Atrataf 1 kg per 1000 lit for 1 ha
18	Irrigation	First – 28 to 30 days after sowing Second – 50 to 55 days after sowing
19	Harvesting, threshing, storage	1. Harvesting at 110 to 120 days after sowing 2. Threshing with threshing machine 3. Storing 10 per cent moisture level

1.3 Need, Scope and Importance of the study

1.3.1 Need of the study

Improved or recommended agriculture practices are the product of modern science and technology. Development of new technology is generally not major problem in our country. The main problem exist today is that acceptance of these technologies by the farmer. Jowar is important crop grown in

Rabi season particularly in Solapur district. It is short duration crop gives better income within short period hence preferred by most of the farmer. But due to uneven nature of rainfall the yield level of jowar crop is not satisfactory. Even though the improved technologies like *Panchsutri* technology are available with farmer. This is because of the lack of scientific knowledge of farmers to accept the new technology. This may be due to the different problems or constraints associated with the technology. Therefore to know the knowledge and adoption of *Panchsutri* technology the study is very much needed.

Considering these different aspects, the present study entitled, 'Knowledge and adoption *Panchsutri* technology in *rabi* sorghum' was undertaken with the following specific objectives.

1.3.2 Objectives of the study

1. To study the personal, socio-economic characteristics of the sorghum growers.
2. To study the knowledge of the sorghum growers about *Panchsutri* technology for *rabi* sorghum.
3. To study the adoption of *rabi* sorghum *Panchsutri* technology by the sorghum growers.
4. To find out relationship between personal, socio-economic characteristics of sorghum growers with their knowledge and adoption of *rabi* sorghum *Panchsutri* technology.
5. To study the constraints faced by the sorghum growers in adoption of *rabi* sorghum *Panchsutri* technology and obtain their suggestions for overcoming the constraints.

1.3.3 Hypotheses

1. There exist relationship between the personal and socio-economic characteristics of sorghum growers and knowledge of sorghum growers about *Panchsutri* technology.
2. There exist relationship between the personal and socio-economic characteristics of sorghum growers and extent of adoption of *Panchsutri* technology.
3. Sorghum growers do face constraints in adoption of *Panchsutri* technology.

1.3.4 Scope and Importance of Study

The outcome of such investigation may help to researchers, extension personnel and policy makers engaged in diffusion of recommended production technology including in large area. Finding emerged in this respect would be useful for the social scientist in general and agricultural extension researchers in particular for developing a village farm production plan. It is also expected that the barriers to some extent in adoption of *Panchsutri* technology in *rabi* jowar would be overcome with the utilization of finding of these study. The finding would be useful in identifying the general trade of adoption of technology in the area. The study attempts to establish the relationship of the personal and socio-economic characteristics with knowledge and adoption which would help to monitor these variables for desired adoption. Thus, significance of present study lies in its practical utility.

1.3.5 Limitations of the study

The study was based on the responses of the sorghum growers, which may not be free from bias, despite of the efforts taken by the researcher, to get objective responses as possible. The present study was conducted in Solapur district of

Maharashtra state. Therefore generalization based on limited area of sample.

As the researcher has to depend upon the recalled memory for information given by farmers, the reliability of information given by the respondents has also a limitation of the study. Application of results in another area will however, depend upon the similarity of ecological system, socio-economic and environmental condition of farmers.

1.3.6 Layout of thesis

The thesis comprises of five chapters. The first chapter 'Introduction' comprises the information about *rabi* sorghum *Panchsutri* technology, objectives, hypotheses, scope and importance of the study and limitations of the study. The second chapter 'Review of Literature' deals with past researches done by earlier researcher. The third chapter, 'Methodology' deals with the methods and procedures used in the present study. The research findings of the study have been presented, interpreted and discussed in the fourth chapter 'Result and Discussion'. A brief summary of the investigation, conclusions, implications and suggestions for further researcher have been given in the fifth chapter 'Summary, Conclusion and Implications'. The literature cited, appendices, interview schedule and vita are appended at the end.

CHAPTER II

REVIEW OF LITERATURE

Review of literature is one of the most important aspects in research process because it acts as a yardstick to the new researchers in carrying out the research. It is important to look in to the past researches, so as to have sound foundation for the research study. In a view of the above subject, efforts have been made to review the relevant literature about the subject.

The available literature on different research studies, like research articles, books, abstracts of seminars and reports having direct and indirect application with the subject of the present study has been reviewed and is presented as under,

2.1 Socio-Personal characteristics of the farmers

The set of variables in the present study included socio-personal, economical characteristics. The situational and communication attributes of the respondents *rabi* sorghum growers are covered under this sub-head. The review of past studies pertaining to those variables has been presented below.

2.1.1 Age

Age is crucial factor in determining the behavior of the individual.

Mate (2006), in his study on, knowledge and adoption of recommended potato cultivation practices by the farmers, reported that 41.50 per cent of the respondent were in middle age group, followed by old age group (40.50 per cent) and young age group (18.00 per cent).

Deshmukh *et al.* (2007), in their study on, knowledge and Adoption of Agricultural Technologies in Marathwada, revealed that majority of the respondents belonged to middle age group

(47.22 per cent) followed by young age group (34.72 per cent) and old age group (18.06 per cent).

Borhade (2011), in his study on, knowledge and adoption of organic manures by the farmers in Akola district, reported that nearly half (48.67 per cent) of the respondents were in middle age group of 36 to 50 years, followed by 38.66 per cent respondents were observed in the old age group of above 51 years. The percentage of respondents in young age group that is up to 35 years was found to be 12.67 per cent.

Dhere (2012), in his study on, a study of the impact of seed village programme on the productivity level of cheackpea participant farmers, indicated that more than half of the farmers (54.62 per cent) belonged to middle age group, while 25.38 per cent of them were belong to young age group and 20.00 per cent belong to old age group.

2.1.2 Education

The level of formal education attended by an individual tends to influence the extent to he is exposed to new ideas through the use of various communication channels.

Zote (2001), in his study on, adoption of dry land technology for Bajra, revealed that 32.00 per cent of respondents were educated upto high school and 39.33 per cent were educated up to college level, while 24.67 per cent of the respondents were educated up to secondary level.

Patil (2002), in his study on, adoption of selected improved dryland farming practices by the farmers, found that about 49.00 per cent of the respondents were educated up to primary level, 30.00 per cent of the respondents up to secondary level and 14.70 per cent of the respondents secured higher education while,6.20 per cent were illiterate.

Deshmukh (2006), in his study on, knowledge and adoption of pigeonpea variety BSMR-736 by the farmers in Jalna district, stated that 44.66 per cent of the respondents were educated up to middle school level, 25.00 per cent of the respondents had taken education up to primary level, 10.00 per cent of the respondents educated up to high school level, 5.84 per cent of the respondents educated up to college level and 5.00 per cent respondents can read and write. Only 7.50 per cent respondents were illiterate.

Khule *et al.* (2009), in their study on, knowledge level of Paddy growers about Low cost crop cultivation technology, observed that majority respondents (63.33 per cent) had undergone education upto high school and graduate level.

Bedre (2009), in his study on, knowledge and adoption of recommended package of practices by Okra growers, observed that 38.33 per cent of respondents were educated up to higher secondary school level and 31.66 per cent of respondents had taken education up to secondary level. While, 18.35 per cent of respondents were educated up to college- level, 8.33 per cent of respondents could read and write only and remaining 3.33 per cent of respondents were illiterate.

Nichal (2010), in his study on, knowledge and adoption of recommended package of practices by jasmine growers in Nanded district, found that majority (45.84 per cent) of respondents were having education up to secondary school level, followed by 18.33 per cent of respondents had completed education up to college level and , 15.00 per cent of respondents were educated up to higher secondary school level, whereas 12.50 per cent of respondents had education up to primary level. Only 8.33 per cent of respondents were illiterate.

Chahande (2012), in his study on, knowledge and adoption of recommended package of practices by the pigeonpea growers in Parbhani district, showed that 40.83 per cent of respondents were educated up to secondary school level, 23.33 per cent of respondents educated up to primary level, 15.00 per cent of respondents were educated up to higher secondary level, 8.33 per cent were illiterate, 6.67 per cent of respondents were educated up to college level and 5.83 per cent of respondents can read and write only.

2.1.3. Social participation

Zote (2001), observed that majority of bajra growers had medium level of social Participation (68.00 per cent) while, 21.33 per cent had low level of social participation and only 10.67 per cent of the respondents had high level of social participation in different organizations.

Bainade (2005), in his study on ,knowledge and adoption of improved cultivation practices of maize by farmers in Jalna district, reported that majority of the respondents (62.50 per cent) had medium level of social participation, followed by low level of social participation (25.00 per cent), while 12.50 per cent respondents were in high level of social participation.

Ghodeswar (2006), in his study on, knowledge and adoption of pre and post harvest technology in pomegranate cultivation, reported that about two third of the pomegranate growers (63.33 per cent) had medium level social participation, while 15.83 per cent of the growers had low level social participation, 15.00 per cent of pomegranate growers had high and 5.84 per cent no social participation.

Deshmukh, *et al.* (2007), in their study on, knowledge and adoption of agricultural technologies in Marathwada, observed

that 45.13 per cent of respondents were from medium level social participation while, remaining 38.88 per cent of respondents had high and 15.97 per cent had low level of social participation respectively.

Wankhede (2004), in his study on, adoption behavior of farmers with reference to selected dryland cultivation practices in washim district, reported that, more than half (58.86per cent) of the banana growers had medium social participation level followed by 26.82 per cent and 14.32 per cent had low and high level of social participation respectively.

Godale (2013), in his study on, adoption of improved package of practices by safflower growers, noticed that higher proportion of respondents (44.53 per cent) had medium level of social participation followed by high level of social participation (41.40 per cent) while, 14.07 per cent of the respondents had low level of social participation.

2.1.4 Farming Experience

Bhagwat (2003), in his study on, adoption of dryland cotton cultivation technology by the farmers, indicated that majority of respondents (79.33 per cent) in medium farming experience group followed by 10.66 per cent were having low farming experience and 10.00 per cent of respondents were in high farming experience group in dry land cotton cultivation.

Ekatpure (2007), in his study on, adoption of dryland cotton cultivation technology by the farmers, observed that 69.33 per cent of the farmers had medium level of farming experience, 17.34 per cent had low level of farming experience while,13.33 per cent farmers had high level of farming experience.

Dalvi (2009), in his study on, knowledge and adoption of pre and post harvest technology by soybean growers, observed that majority of respondents (61.25per cent) had medium farming experience followed by high farming experience (22.5per cent) and low farming experience (16.25per cent) respectively.

Nichal (2010), noticed that 70.00 per cent of respondents had medium farming experience, 16.66 per cent of respondents had low farming experience and 13.34 per cent of respondents had high farming experience.

Lad (2013) in his study on, knowledge and adoption of recommended package of practices of green gram, revealed that 65.00 per cent of the green gram growers had experience of 9 to 32 years while, 20.00 per cent respondents had more than 33 years farming experience and 15 per cent had experience of up to 8 years.

2.2 Economic characteristics of the farmers

2.2.1 Annual income

Zote (2001), observed that 70.67 per cent of respondents had medium level of annual income, 16.66 per cent had high level of annual income while, 12.66 per cent of the respondents had low level of annual income.

Parhad (2002), reported that most of respondents (48.00 per cent) had their annual income ranging from Rs. 50,000/- to Rs 1,00,000/-. About one fourth of respondents (25.33 per cent) were under the group of annual income ranging from Rs. 1,00,000 to 1,50,000/- followed by 17.33 per cent respondents had their annual income Rs. 1,50,000/- to 2,00,000/-. Very few respondents i.e. 6.67 per cent and 2.67 per cent had their annual income between Rs. 2,00,001/- to 2,50,000/- and 2,50,001/- and above, respectively.

Deshmukh *et al.* (2007), observed that majority of the respondents (81.59 per cent) fall under medium level of annual income while, 10.76 per cent respondents had high level of annual income and remaining only 7.63 per cent had low level of annual income.

Ekatpure (2007) observed that 34.00 per cent and 28.00 per cent of cotton growers belonged to the category of up to Rs. 30,000/- and Rs. 30,000/- to 60,000/- income group respectively, while only 19.33 per cent and 18.67 per cent of the cotton growers belonged to the category of Rs. 60,001/- to 90,000/- and above Rs.90, 000/- annual income categories respectively.

Katke (2011), observed that majority of the respondents (60.00 per cent) had low level of annual income, 20.83 per cent of the respondents had high level of annual income while, 19.17 per cent of the respondents had medium level of annual income.

Chahande (2012), reported that majority (60.66 per cent) of respondents had medium level of annual income (Rs.18001/- to 85001/-) while, 20.83 per cent of respondents had high level of annual income (Rs. 85001/- to above) and only 17.51 per cent of respondents had low annual income (up to Rs. 18000/-).

2.2.2 Land holding

Ramteke (2001), in his study on, adoption of recommended package of practices of pigeonpea, observed that majority (45.00 per cent) of the respondents had medium land holding followed by 40.83 per cent of the respondents had big land holding and 14.17 per cent had small land holding.

Zote (2001), noticed that majority (70.67 per cent) of respondents were medium land holders, 18.00 per cent were big land holders and 11.33 per cent were low land holders.

Bainade (2005), observed that 57.50 per cent of the respondents had medium land holding, 21.67 per cent respondents had big land holding while, 20.83 per cent of respondents had small land holding .

Dandnaik (2009), revealed that 35.84 per cent of respondents had medium land holding, 23.34 per cent had medium land holding followed by 20.83 per cent and 16.66 per cent of respondents had big and small land holding respectively, only 3.33 per cent of respondents belonged to marginal land holding .

Khuspe (2012), observed that 35.01 per cent of respondents were small farmers (1.1 to 2 ha) followed by 34.16 per cent of respondents were semi-medium farmers (2.1 to 4 ha), 17.51 per cent of the respondents were from medium farmers (4.1 to 10 ha) while, 09.16 per cent and 04.16 per cent of the respondents were marginal farmers (up to 1 ha) and big farmers (10.1 ha and above), respectively.

Singh *et al.* (2014), observed that half of the respondents (51.00 per cent) were having small land holding (2.01-3.00 acres). However, 23.34 per cent were marginal farmers (below 2.00 acres), 23.00 per cent were small farmers (3.01 to 4.00 acres) and 02.66 per cent were semi-medium farmers (4.01 to 5.00 acres).

2.3. Communicational characteristics of the farmers (Source of Information)

Mate (2006), in his study on, knowledge and adoption of recommended potato cultivation practices by the farmers,

reported that 70.50 percent of respondents were using medium source of information.

Yadav et al. (2007) in his study on, knowledge and adoption of scientific wheat cultivation practices, reported that most of the wheat growers (82.50 per cent) were in medium category of sources of information utilization. In this respect, relatives and traders were main sources for information on marketing agency, market preference of consumers, package of practices of vegetable cultivation etc.

Maghade (2007) in his study on, technological gap in onion cultivation from Rahata tahsil of Ahmednagar district, observed that 69.50 per cent of the respondents had used medium sources of information whereas, 20.00 per cent had used high sources of information and 10.50 per cent of the respondents had used low sources of information respectively.

Pawar (2008), reported that majority of the respondents (52.50 per cent) were included in medium category of sources of information. As much as 26.67 per cent of respondents found to be having low level of sources of information, only 20.83 per cent of respondents were found to be using higher level of sources of information.

Zunjar (2011), observed that 56.33 per cent of the respondents had used high sources of information followed by medium sources of information (28.39 per cent) and low sources of information (12.45 per cent).

Chahande (2012), noticed that majority (43.33 per cent) of respondents had medium use of source of information, whereas, 37.50 per cent of respondents had low use of sources of information followed by 19.17 per cent of the respondents had high level sources of information.

Lad (2013), revealed that more than two third (70.00 per cent) of the green gram growers used medium sources of information while, 15.83 per cent used high sources of information and 14.17 per cent used low sources of information.

2.3.1 Personal localite source of information

Jalak (2002) reported that 66.67 percent of the farmers had medium level use of sources of information, followed by 19.33 per cent had low level and 14.00 per cent had high level use of source of information.

Patil (2015), revealed that 51.38 percent of the respondents had medium level use of sources of information, followed by 36.81 per cent had high level and 11.81 per cent had low level use of source of information.

2.3.2 Personal cosmopolite source of information

Patil (2015), observed that 65.28 percent of the respondents had low level use of sources of information, followed by 30.90 per cent had medium level and 3.82 per cent had low level use of source of information.

2.3.3 Extension education methods as source of information

Patil (2015), reported that 55.90 per cent of the farmers had used extension education methods as source of information to low extent, followed by medium extent (37.85 per cent) and high extent (06.25 per cent).

2.3.4 Mass media source of information

Patil (2015), noticed that 53.82 per cent of the farmers belonged to low level of mass media utilization category, followed by medium (36.11 per cent) and high (10.27 per cent).

2.4 Knowledge level of farmers about Panchsutri technology in rabi sorghum.

Zote (2001), observed that the level of knowledge of most of respondents (61.33 per cent) about recommended dry land technology for bajra crop was medium , high level of knowledge possessed by 22.67 per cent respondents and only 16.00 per cent respondents had low level of knowledge.

Bainade (2005), observed that 61.67 per cent of respondents had medium level of knowledge followed by 23.33 per cent of the respondents had low level of knowledge while, 15.00 per cent of respondents had high level of knowledge about improved cultivation practices of maize.

Kothari *et al.* (2006), in his study on, extent of knowledge and adoption of maize production technologies by the farmers, revealed that majority of beneficiary respondents (38.00 per cent) possessed medium level of knowledge, whereas 32.00 per cent beneficiaries had low level of knowledge and 30.00 per cent farmers possessed high level of knowledge about improved maize cultivation technology.

Yadav *et al.* (2007), observed that most of the farmers had medium level of knowledge (60.26 per cent), followed by high level of knowledge (24.36 per cent) and low level of knowledge (15.38 per cent) about scientific wheat cultivation practices in Bihar and Haryana.

Mahadik *et al.* (2009), in his study on, knowledge and adoption behavior of farmers growing Sahyadri (KRH-1) variety of rice, observed that 59.25 per cent of the respondents had medium level of knowledge, while 19.25 per cent and 21.50 per cent of the respondents had low and high level of knowledge respectively.

Suhasini (2009), in her study on, adoption of chickpea cultivars in AP: pattern, trend and constraints, reported that 58.70 per cent of respondents possessed medium knowledge level, 29.16 per cent farmers had low knowledge level followed by 12.14 per cent had high level of knowledge.

Chahande (2012), observed that majority (68.33 per cent) of the respondents had medium level of knowledge whereas, 16.67 per cent and 15.00 per cent of the respondents had low and high level of knowledge about recommended package of practices of pigeon pea.

2.5 Adoption level of farmers about *Panchsutri* technology in rabi sorghum.

Borse (2002), observed that 73.52 per cent of the respondents belonged medium level of adoption, 32.73 per cent had low level of adoption and only 14.54 per cent had high level of adoption of IPM technology in hybrid cotton.

Kothari *et al.* (2006), observed that 44.00 per cent respondents had medium level of adoption, 36.00 per cent had low level of adoption while, 20.00 per cent farmers had high level of adoption about maize production technologies.

Deshmukh *et al.* (2007), observed that 81.94 per cent of the respondents were falling under low level of adoption followed by 12.00 per cent of the respondents had medium level of adoption and 06.06 per cent of the respondents had high level of adoption.

Yadav *et al.* (2007), observed that in Bihar, majority of the respondents (71.79 per cent) had medium level of adoption, followed by high level of adoption (16.67 per cent) and low level of adoption (11.54 per cent). In Haryana, most of the respondents were found to have medium level of adoption (78.75

per cent), followed by (12.50 and 08.75 percent) of them having low and high level of adoption, respectively

Dandnaik (2009), reported that majority (60.00 per cent) of respondents had medium level of adoption, (22.50 per cent) of them had low level of adoption and (17.50 per cent) of the respondents had high level of adoption regarding recommended package of practices of pigeonpea.

Chahande (2012), observed that majority (60.66 per cent) of the respondents had medium level of adoption, 22.50 per cent of them had low level of adoption and 15.84 per cent of the respondents had high level of adoption regarding recommended package of practices of pigeonpea.

Lad (2013), revealed that more than seventy percent (72.50 per cent) of the green gram growers had medium level of adoption of recommended package of practices of green gram while, 14.17 per cent and 13.33 per cent of the respondents had low and high level of adoption, respectively.

2.6 Relationship between socio-personal, economic and communicational characteristics of farmers with the knowledge level of *Panchsutri* technology in *rabi* sorghum.

2.6.1 Age and Knowledge

Singh *et al.* (2001) found that age of the farmers had negative but significant relationship with improved agricultural technologies and household technologies.

Jalak (2002) revealed that age had a negative but significant relationship with their knowledge of the farmers about improved farm implements.

Dhere (2012) reported that age had a positive and significant correlation with knowledge of farmers about farm mechanization.

2.6.2 Education and knowledge

Zote (2001) found that education was positively and significantly related with knowledge level of dry land technology of bajra.

Asane (2003) noticed that education had positive and significant relation with the knowledge about cultivation practices recommended for soybean.

Sawale (2011) observed that there was positive and highly significant relationship between the education and their level of knowledge of the pomegranate growers about post harvest technology.

Lad (2013) found that education was positively and significantly related with knowledge about recommended package of practices of green gram.

Singh *et al.* (2014) found that education was positively and significantly related with knowledge and attitude of farmers about improved wheat production technology.

2.6.3 Social participation and knowledge

Zote (2001) observed that social participation had positive and significant relationship with knowledge about recommended dry land technology of bajra.

Bainade (2005) inferred that social participation had positively and highly significantly related with knowledge of improved cultivation practices of maize crop.

Bedre (2009) observed that social participation had positive and significant relationship with knowledge of the farmers about improved cultivation practices of okra.

Singh *et al.* (2014) found that social participation was positively and significantly related with knowledge and attitudes of farmers with improved wheat production technology.

2.6.4 Farming experience and knowledge

Asane (2003) found that age of the respondents had negative and significant relationship with knowledge about cultivation practice recommended for soybean.

Ghodeswar (2006) found that farming experience of pomegranate growers had positive and significant relationship with knowledge about pre and post harvest technology in pomegranate.

Bedre (2009) observed that the relationship of an experience was negative and highly significant with the level of knowledge of mango growers.

Sawale (2011) showed that the farming experience was positively and significantly related with the level of knowledge of post harvest technology of pomegranate.

Lad (2013) found that farming experience was non-significantly related with the knowledge about recommended package of practices of green gram.

2.6.5 Annual income and knowledge

Zote (2001) observed that annual income was positively and highly significantly related with knowledge of dry land technology of bajra.

Asane (2003) noticed that annual income had positive and significant relationship with the knowledge of farmers about cultivation practice recommended for soybean

Bainade (2005) observed that annual income was positively and significantly related with knowledge of the improved cultivation practices of maize.

Lad (2013) found that annual income was positively and significantly related with knowledge about recommended package of practices of green gram.

Singh *et al.* (2014) found that annual income was positively and significantly related with knowledge of farmers with improved wheat production technology.

2.6.6 Land holding and knowledge

Zote (2001) observed that land holding was positively and highly significantly related with knowledge level of dry land technology of bajra.

Asane (2003) noticed that land holding had positive and significant relationship with the knowledge of farmers about cultivation practice recommended for soybean.

Bainade (2005) observed that land holding was positively and significantly related with knowledge level.

Lad (2013) found that land holding was non-significantly related with knowledge about recommended package of practices of green gram.

Singh *et al.* (2014) found that land holding was positively and significantly related with knowledge of farmers with improved wheat production technology.

2.6.7 Sources of Information and knowledge

Zote (2001) found that source of information had positive and significant relationship with knowledge about recommended dry land technology of bajra.

Parhad (2002) observed positive and significant relationship between knowledge level of maize growers and their extent of source of information.

Badale (2007) observed that sources of information had established the positive and highly significant relationship with

knowledge of recommended production technology of soybean.

Chahande (2012) observed that sources of information was not significantly associated with knowledge of recommended package of practices of pigeonpea.

Lad (2013) found that source of information was positively and significantly related with knowledge about recommended package of practices of green gram growers.

Patil (2015) found that source of information showed a positive and highly significant relationship with their knowledge level.

2.7 Relationship between socio-personal, economic and communicational characteristics of farmers with the adoption level of *Panchsutri* Technology of *rabi* sorghum.

2.7.1 Age and adoption

Bannapure (2006) observed that relationship between age and the level of adoption was negative but significant.

Bahire (2011) indicated that relationship between the age and adoption level was negative and highly significant.

2.7.2 Education and adoption

Parhad (2002) observed that adoption of maize cultivation practices was positively and significantly related with education.

Bainade (2005) observed that relationship between education and adoption was positive but significant.

Maghade (2007) reported that education level of the onion growers and adoption of improved practices of onion cultivation was negative but significantly correlated.

Lad (2013) found that education was positively and highly significantly correlated with adoption about recommended package of practices of green gram growers.

2.7.3 Social participation and adoption

Zote (2001) observed positive and significant relationship with adoption of recommended dry land technology for bajra.

Parhad (2002) observed positive and significant relationship between social participation and adoption of improved cultivation practices of maize.

Borse (2002) found that social participation and adoption had positive and significant relationship.

Shinde (2003) observed that there was a significant relationship between social participation and adoption behavior of groundnut grower.

Bainade (2005) observed that positive and highly significant relationship with adoption of recommended improved cultivation practices of maize.

2.7.4 Farming experience and adoption

Ekatpure (2007) reported that there was non significant relationship between farming experience and adoption level of farmers.

Dandanaik (2009) observed that farm experience is not significantly associated with adoption of recommended package of practices of pigeon pea.

Nichal (2010) observed that farm experience did not show any relationship with adoption of recommended package of practices of jasmine.

Singh et al. (2010) observed that farming experience had positive and significant relationship with technological gap in sugarcane-wheat cropping system.

Lad (2013) found that farming experience had no any relationship with adoption about recommended package of practices of green gram.

2.7.5 Annual income and adoption

Parhad (2002) observed that there was positive and highly significant relationship between annual income and adoption of maize cultivation practices by maize growers.

Bainade (2005) observed that there was positive and significant relationship between annual income and adoption of recommended improved cultivation practices of maize.

Sawale (2011) observed that the relationship between annual income and adoption level about post harvest technology of the pomegranate growers was positive and highly significant.

Lad (2013) found that annual income was positively and significantly related with adoption about recommended package of practices of green gram.

2.7.6 Land holding and adoption

Zote (2001) was found that land holding was positively and significantly related with adoption of bajra production technology.

Bainade (2005) found that land holding was positively and highly significantly related with adoption of maize production technology.

Suhasini (2009) found that size of land holding and adoption level had positive but non-significant relationship.

Nichal (2010) observed that land holding did not showed any relationship with the adoption of recommended package of practices of jasmine.

Sawale (2011) observed that land holding was positive and significantly related with the level of adoption of post harvest technology of the pomegranate.

Lad (2013) found that land holding was non-significantly related with adoption of recommended package of practices of green gram.

2.7.7 Source of information and adoption

Sonawane *et al.* (2009) observed that source of information was positively and significantly related with the level of adoption.

Chahande (2012) observed that source of information was not significantly associated with adoption of recommended package of practices of pigeon pea.

Lad (2013) found that source of information was positively and highly significantly related with adoption of recommended package of practices of green gram.

2.8 Constraints faced by the farmers in *Panchsutri* technology in *rabi* sorghum.

Kadam (2000) reported that 75.00 per cent of the respondents faced the constraints of non availability of labours at the time of harvesting while, 56.25 per cent, 53.12 per cent and 50.00 per cent of the respondents expressed that lack of knowledge about compost making, non-availability of spraying appliances and no surety of benefit due to seed treatment were the major constraints for them.

Ramteke (2001) reported that 65.00 per cent of the respondents faced constraints regarding lack of knowledge for preparation of compost, followed by non-availability of seed materials (81.67 per cent), high cost of fertilizers (84.74 per cent), high cost of insecticides (59.17 per cent), inadequate plant

protection equipment (83.33 per cent), non-availability of labours at the time of harvesting (85.35 per cent), and high cost of agriculture inputs (70.00 per cent).

Kothikhane (2003) reported that costliness of chemical fertilizers (58.85 per cent), high cost of compost (78.28 per cent), non-availability of improved seed drill for adopting recommended spacing (51.42 per cent), no surety of benefits due to seed treatment (37.14 per cent) were the major constraints expressed by the bajra growers.

Deshmukh (2006) reported that majority of the respondents faced the constraints of lack of scientific knowledge about plant protection measures (62.50 per cent), high cost of seed material (54.16 per cent), non-availability of labors at the time of harvesting (50.00 per cent), lack of knowledge about seed treatment (47.50 per cent) and high cost of FYM (42.50 per cent).

Deshmukh *et al.* (2007) revealed that respondents faced the constraints that no information about variety released and agricultural technologies recommended by MAU (62.50 per cent), while lack of knowledge about seed rate and place of sale (56.94 per cent). More than half (52.77 per cent) respondents expressed that non availability of seed, travelling over long distance for seed purchase and seed is not available on due time.

Chaudhari (2011) in his study reported that farmers faced the constraints like lack of training programmes (91.66 per cent), high cost of insecticides, weedicides, fungicides (83.44 per cent), lack of technological knowledge (82.50 per cent) and high cost of chemical fertilizers (76.11 per cent).

Laborite (2012) in his study found that the major reasons for non adoption of recommended technology were ignorance of

the farmers about technology, non availability of inputs in proper time and high cost of the recommended technology.

Godale (2013) observed that majority (89.06 per cent) of the respondents had reported the constraint of high cost of pesticides and insecticides. While, high price of improved seeds was expressed by 88.28 per cent of the respondents. Whereas, 81.25 per cent of the respondents had reported constraint of unavailability of chemical fertilizers during the season.

2.9 Suggestions of farmers to overcome the constraints of *Panchsutri* technology in *rabi* sorghum

Bhosale (2004) reported suggestions of pomegranate cultivators were a need of proper provision for obtaining remunerative price of pomegranate (93.13 per cent), providing reasonable transporting charges (78.13 per cent), government should provide minimum supportive price (63.13 per cent), and government should encourage to start processing unit in rural area.

Thorat *et al.* (2004) reported that majority (89.44 per cent) of the respondents suggested that technical information in respect of latest technologies should be given to the farmers followed by demonstrations of improved varieties be conducted on farmers field (57.22 per cent), planting material of improved varieties be made available (85.55 per cent) and low cost technology of sugarcane cultivation be generated by the university (53.89 per cent) and there should be close linkage between scientists and farmers (37.22 per cent).

Solanki *et al.* (2004) revealed that about two third (62.37 per cent) growers suggested that cost of inputs should be reduced, followed by 54.00 per cent suggested that improved implements should be made available to the growers.

Mane (2005) pointed out the suggestions like remunerative price to marketable soybean produced in the market (83.00 per cent), providing chemical fertilizer at subsidized rate (80.50 per cent), availability of high yielding variety seed (78.00 per cent) and availability of pesticide (73.00 per cent).

Maghade (2007) observed the major suggestions of onion growers viz., stable market price for onion (74.16 per cent), co-operative marketing societies to be established (60.83 per cent), government should fix the minimum support price for onion (78.33 per cent), NAFED need to purchase onion at reasonable rate (58.33 percent) and effective and efficient marketing system (57.50 per cent).

Ghodeswar (2006) indicated that most of the orchard owners had made suggestion about adequate provision for obtaining remunerative price of fruits (92.50 per cent), 77.50 per cent had suggested for reasonable transportation charges, 70.00 per cent of the respondents had asked for governments encouragement for starting processing unit in rural area and provision of minimum supportive price by government should be given (62.50 per cent).

Godale (2013) reported that 28.12 per cent of the respondents had asked for co-operative transport facilities should be made available. Some of the respondents (27.34 per cent) suggested for reasonable transportation charges.

CHAPTER III

METHODOLOGY

The scientific study requires adoption of appropriate methods and procedures in order to reach reliable, unbiased and specific conclusion. This chapter describes in detail the general information about the research location, selection of respondents, designing of interview schedule, techniques followed in measurement of concepts, analysis and interpretation of data.

In short this chapter deals with 'where' and 'how' the research was carried out and the methods which were used for statistical analysis. The aspects covered under this chapter are presented under the following headings.

- 3.1 Locale of the research study
- 3.2 Information about the selected research area.
- 3.3 Sample and sampling technique
 - 3.3.1 Selection of tahsils
 - 3.3.2 Selection of villages
 - 3.3.3 Selection of respondents
- 3.4 Selection and measurement of variables
- 3.5 Development of interview schedule
- 3.6 Pretesting of interview schedule
- 3.7 Tools and methods used for data collection
- 3.8 Processing and compilation of data
- 3.9 Statistical tools used for analysis of data
- 3.7 Definitions of terms and concepts

3.1 Locale of the research study

The present study was conducted in Solapur district of Maharashtra state. The Solapur district was selected for the study because Solapur has largest area and production of rabi

sorghum under dryland condition and the *Panchsutri* technology is specially developed for rabi sorghum in dryland condition.

3.2 Information about the selected research area.

3.2.1 Geographical Location

Solapur district a widely known drought prone district of Maharashtra extends geographically from 17°10' to 18°32' North latitude to 74°42' to 76°15' East longitude. It is well connected by road, rail & airways from Bombay, Hyderabad & Bangalore. The district is situated on the south east fringe of Maharashtra State and lies entirely in the Bhima and Seena basins. Whole of the district is drain either by Bhima river or its tributaries. The district is bounded on the north by Ahmednagar and Osmanabad districts, on the east by Osmanabad and Gulbarga (Karnataka State) districts, on the south by Sangli and Bijapur (Karnataka State) and on the west by Satara and Pune districts. Out of the total area of the district 338.8 sq. kms (2.28%) is urban area whereas remaining 14505.8 sq. kms. (97.72%) is rural area. The district is spread over 14,895 sq.km. with 11 tahsils, 1,138 villages and 1,030 *gram panchayats*. Solapur occupies 4.82% area & contains 4.10 % population of Maharashtra State. (Anonymous, 2014 B.)

3.2.2 Climate

The climate of the district is very good due to high lands on the western part and gradual slope towards east and north, and on the western side with moderate summer from April to June and good winter from November to March. The climate during rainy season from the middle of the June to end of September is cool and pleasant followed by a hot spell of October. The temperature of the district goes up to 46° C in summer and in winter it falls down to 9° C.

3.2.2 Rain Fall

The rainfall in this district is more or less uniform in the past decade. The average rainfall of the district is between 500 mm to 650 mm.

3.2.3 Soil

The soils of the district can broadly be classified into three types viz. Black soil , coarse gray soil and reddish soil.

3.2.4 Zones of Solapur

According to topography the district is divided in three natural zones.

- **Eastern Zone:** This comprises of Barshi, North Solapur, South Solapur and Akkalkot Tahsils. The soil is medium to deep black and of rich quality. Jawar, Bajra and Pulses are the main crops of this zone.
- **Central or Transitional Zone:** Mohol, Mangalwedha, eastern part of Pandharpur and Madha Tahsils are covered by this zone. Like to moderate soil and uncertain rainfall marks this zone. Both Kharif and Rabbi Crops are grown in this zone.
- **Western Zone:** Karmala, Sangola and Malshiras Tahsils and western parts of Pandharpur comes under this zone. Shallow and poor type of soil, not retentive of moisture marks this part. Scanty and uncertain rainfall. Rabbi crops mainly grown in Karmala, Pandharpur and Madha Tahsils while Kharif crops like Bajra and Groundnut are grown in Sangola and parts of Malshiras tahsils.

3.2.5 Agroclimatic zones of Solapur districts

Solapur district was identified as one of the 72 districts in India's drought prone area. The district is divided into two major agro climatic zone viz. Scarcity zone and Plain (Transition) zone.

Scarcity zone

Low and erratic rainfall, poor soil with low organic matter and poor moisture holding capacity are constraints leading low yield of crops.

The natural vegetation is of low, scattered shrubs with discontinuous thorny thickets. The general topography is of undulating or rolling plains.

Rabi sorghum, *bajra* and wheat are major cereals; among different pulses red gram in *kharif* and Bengal gram in *rabi* are grown extensively. Similarly, oilseeds i.e. sunflower and safflower are grown on sizable area.

Transition zone

Soils are predominantly deep soils having depth more than 90 cm and rainfall is between 600 to 700 mm. Distribution of rains is inadequate, erratic and irregular. Rolling topography is the characteristics feature of transition zone.

Bajra-gram + safflower, cowpea for fodder + *udid-rabi* sorghum, sunflower-gram are the major cropping systems.

3.3 Sample and sampling technique

3.3.1 Selection of tahsils

Three tahsils namely Mangalwedha, Mohol and North Solapur were selected for present investigation on the basis of their area, production and productivity under rabi sorghum cultivation. Similarly two villages from each tahsils were identified as per the area under sorghum cultivation.

3.3.2 Selection of Respondents

The list of sorghum growers was obtained from agriculture assistant, *gramsevak*, *talathi* of respective villages. Thus 120 respondents i.e. 40 from each tahsil were selected by proportionate random sampling method.

Table 5: Village wise selection the of respondents

Sl. No.	District	Tahsil	Village	Respondent
1	Solapur	Mangalvedha	Nandeshwar	20
			Bhose	20
		Mohol	Khavani	20
			Pokharapur	20
		North Solapur	Majrewadi	20
			Kumthe	20
Total	1	3	6	120

3.4 Selection and measurement of variables

A variable is something which varies. In other words, variables are characteristics or conditions that can be observed, manipulated or controlled by the researcher. With this understanding, variables included in the present study were selected as per the objectives of the study. The variables studied along with the instruments used for measuring them are given below.

3.4.1 Independent variables

The phenomenon or characteristics hypothesized to be the input or antecedent variable is called independent variable.

3.4.1.1 Age

Age is the number of completed years by the respondents at the time of data collection. Here the chronological age of the respondents at the time of interview was taken into consideration. All the respondents were classified according to their age, into three categories on the basis of mean and standard deviation.

Sl. No.	Category	Age (Years)
1	Young (Mean – SD)	Up to 38
2	Middle (Mean $\pm$ SD)	39 to 55
3	Old (Mean + SD)	56 and above
Mean = 46.77		SD= 8.96

3.4.1.2 Education

Education is defined as the number of years of formal education successfully completed by the respondent at the time of data collection.

The level of formal education attained by an individual tends to influence the extent to which he is exposed to new ideas through the use of various communication channels.

According to their formal education the respondents were categorized into five groups viz.,

Sl. No.	Category	Formal education (Standard)
1	Illiterate	Having no formal education
2	Primary education	1 st to 7 th standard
3	Secondary education	8 th to 10 th standard
4	Higher Secondary education	11 th to 12 th standard
5	Graduate and Post Graduate	13 th standard and above

3.4.1.3 Social participation

It is defined as involvement of respondents in formal and informal organization in the village and nearby at his or her locality.

This variable was quantified by using the scale developed by Nirban (2004) with slight modifications. A score of one was assigned to a respondent when he/she was a member of organization and two score is assigned to a respondent who was office bearer of an organization. Further, an additional score of

two, one and zero was assigned for regular, occasional and no attendance to meetings, respectively. Based on total score obtained by the respondents on the social participation, they were grouped into three categories on the basis of mean and standard deviation as follows,

Sl. No.	Category	Social participation (Score)
1.	Low (Mean – SD)	Up to 6
2.	Medium (Mean $\pm$ SD)	7 to 10
3.	High (Mean + SD)	11 and above
Mean = 8.37		SD = 2.51

3.4.1.4 Farming experience

It refers to the number of years the respondents were actively engaged and involved in farming activity. All the respondents were grouped in to three categories on the basis of mean and standard deviation.

Sl. No.	Category	Farming experience (Score)
1.	Less (Mean – SD)	Up to 19
2.	Moderate (Mean $\pm$ SD)	20 to 37
3.	More (Mean + SD)	38 and above
Mean=28.51		SD=9.83

3.4.1.5 Annual Income

The total annual income of the respondent and his family in rupees, received from all the sources in a year was considered. On the basis of total annual gross income, the respondents were classified into three categories on the basis of mean and standard deviation.

Sl. No.	Category	Annual Income (Rs.)
1	Low (Mean – SD)	Up to Rs.64762/-
2	Medium (Mean $\pm$ SD)	Rs.64763/- to Rs.256257/-
3	High (Mean + SD)	Rs.256258/- and Above
Mean = Rs. 1,60,510.20/-		SD = Rs. 95,747.81/-

3. 4.1.6 Land holding

Land holding refers to the number of hectares of land possessed by the respondents. The respondents were grouped in five categories using the criteria adopted by Ministry of Rural Development, GOI Circular No. 280-12/16/19-RD-III (Vol.II) Dated. 15th November, 1991.

Sl. No.	Category	Land holding (ha)
1	Marginal farmers	Up to 1.00
2	Small farmers	1.01 to 2.00
3	Semi-medium farmers	2.01 to 4.00
4	Medium farmers	4.01 to 10.00
5	Big farmers	10.01 and above

3.4.1.7 Sources of information

It refers to various information sources, communication channels used by the respondents for getting information regarding *Panchsutri* technology. Total score was worked out and on the basis mean and standard deviation respondents were classified into following categories. This variable was measured using the procedure followed by Patil (2015) with slight modifications.

Sl. No.	Category	Information sources (scores)
1.	Low (Mean – SD)	Up to 39
2.	Medium (Mean $\pm$ SD)	40 to 84
3.	High (Mean + SD)	85 and Above
Mean = 62.04		SD = 22.93

3.4.1.7.1 Personal localite

Here it referred to the frequency of contact or exposure of the respondent to local personnel's such as friends, neighbours, relatives, progressive farmers, local leaders and Agro Service Centres for obtaining the information. Total score was worked out and on the basis mean and standard deviation respondents were classified into following categories.

Sl. No.	Category	Personal localite sources use (score)
1.	Low (Mean – SD)	Up to 12
2.	Medium (Mean $\pm$ SD)	13 to 24
3.	High (Mean + SD)	25 and above
Mean = 18.76		SD = 6.51

3.4.1.7.2 Personal cosmopolite

It referred to the frequency of contact or exposure of the respondent to extension personnel from Agriculture Department, *Panchayat Samiti*, Agricultural Universities, Agricultural Research Stations and Krishi Vigyan Kendras for obtaining the agriculture information. Total score was worked out and on the basis mean and standard deviation respondents were classified into following categories.

Sl. No.	Category	Personal cosmopolite sources use (score)
1.	Low (Mean – SD)	Up to 6
2.	Medium (Mean $\pm$ SD)	7 to 26
3.	High (Mean + SD)	27 and above
Mean = 16.55		SD = 10.10

3.4.1.7.3. Extension Education methods

Here it referred to the frequency of contact or exposure of the respondent to Group discussion, Demonstration, *Shivarpheri*, Farmers rallies, Exhibitions and Study tours and

others for obtaining the information. Total score was worked out and on the basis mean and standard deviation respondents were classified into following categories.

Sl. No.	Category	Extension methods use (score)	Education
1.	Low (Mean – SD)	Up to 5	
2.	Medium (Mean $\pm$ SD)	6 to 12	
3.	High (Mean + SD)	13 and above	
Mean = 09.35		SD = 04.06	

3.4.1.7.4 Mass media

Here it referred to the frequency of contact or exposure of the respondent to electronic media such as radio, television, internet, CDs/DVDs and mobile and to print media such as newspapers, leaflets/folders, farm magazine, *Shri Sugi* , *Krishidarshani* and others. Total score was worked out and on the basis mean and standard deviation, respondents were classified into following categories.

Sl. No.	Category	Mass media use (score)
1.	Low (Mean – SD)	Up to 12
2.	Medium (Mean $\pm$ SD)	13 to 23
3.	High (Mean + SD)	24 and above
Mean = 17.66		SD = 06.15

3.4.2 Dependent variables

3.4.2.1 Knowledge

English and English (1961) defined knowledge as a body of information possessed by individual. An individual gains or increases his knowledge through communication. For the purpose of this study, it was defined as factual information possessed by the farmers about *Panchsutri* technology in *rabi sorghum*.

For measuring the knowledge level of the respondents, two point continuum was used and the numerical value was assigned to the responses received from the respondents. The numerical score 1 was assigned for complete knowledge and 0 for the partial knowledge and no knowledge of each practice of *panchsutri* technology.

The total knowledge score of each respondent was worked out. The respondents were categorized into following three groups low, medium and high. The respondents were categorized by the formula on the basis of $\text{mean} \pm \text{S.D.}$

Sl. No.	Category	Knowledge Score
1	Low (Mean – SD)	Up to 11
2	Medium (Mean $\pm$ SD)	12 to 19
3	High (Mean + SD)	20 and Above
Mean = 15.92		SD = 4.44

3.4.2.2 Adoption

It is mental process through which an individual passes from first hearing about an innovation to final adoption. It is operationalized as a process by which respondent passes from first knowledge of *Panchsutri* technology to a decision to adopt or reject the technology.

For measuring the adoption level of the respondents, three point scales were used and the numerical value was assigned to the responses received from the respondents. The numerical score '2' was assigned for complete adoption, '1' for the partial adoption and '0' for non- adoption of each practice of *Panchsutri* technology.

The total adoption score of each respondent was worked out. The respondents were categorized into three groups low, medium and high on the basis of mean and standard deviation as below.

Sl. No.	Category	Adoption Score
1	Low (Mean – SD)	Up to 19
2	Medium (Mean $\pm$ SD)	20 to 33
3	High (Mean + SD)	34 & above
Mean = 26.46		SD = 7.83

Constraints

Constraints are the factors that limit the adoption process and hence these cannot be overlooked. In the present study constraints have been operationally defined as the problems encountered by the *rabi* sorghum growers in adoption of *panchsutri* technology. The constraints in adoption of *panchsutri* technology were identified by asking the close ended question to respondents. The constraints faced by them were recorded. The constraint was remarked to measure the constraints encountered by the respondents. The categorization of the respondents on the basis of constraint faced by them in adoption of *panchsutri* technology was done by remarking each constraint from higher majority to lower majority of the respondents.

Suggestions

Suggestions of respondents that means the opinions or solutions for the constraints were also obtained from the respondents in adoption of *Panchsutri* technology in *rabi* sorghum.

3.5 Development of interview schedule

On the basis of objectives of the study and the variables, the interview schedule was developed for the collection of the data. The interview schedule was in mother tongue i.e. in *Marathi*, for the convenience of the respondents and for accurate responses from them while collecting the data. The schedule was prepared in such a manner that the dual meaning questions and contradictory statements were avoided. The language of questions was simple and easy for understanding of the respondents.

Questions related to socio-economic aspects of respondents having possible correlation with knowledge of that system were designed. The questionnaire leading to understand their constraints and obtaining suggestions were also included in the study.

3.6 Pretesting of interview schedule

Pretesting of interview schedule was carried out to test its accuracy and suitability. It also important to find out whether the schedule designed for data collection gave required information for the study. The farmers who were used as respondents for pretest of an interview schedule were different from those of the respondents under study. However, the socio-economic and situational factors of these farmers were similar to the selected farmers who were respondents of the study. After pretesting of the schedule, necessary improvements were made in the drafts schedule and then sufficient numbers of copies were prepared of the refined schedule.

3.7 Tools and methods used for data collection

The data were collected through face to face contact method by contacting the selected farmers at their houses or

their farms as per their convenience. Before actual seeking information, farmers were introduced with the objectives of the present study. The pre-tested interview schedule was used for data collection. While interview respondents were assured that the information furnished by them would be kept confidential and would use only for research study.

3.8 Processing and compilation of data

The information collected from farmers through personal interview schedule was processed through primary and secondary tables. The data of qualitative nature was converted into quantitative form and computation of score was done for each dependent and independent variables. Statistical methods such as percentage, mean, standard deviation and coefficient of correlation was used. The collected information was compiled according to the objectives, nature, concepts and variables of the study. The relevant relationship was obtained by feeding the data to the computer which facilitated accurate and easy analysis. This all process helped to establish the significance of the results and to correlate the selected independent and dependent variables.

3.9 Statistical tools used for analysis of data

The data collected from the respondents was scored, tabulated and analyzed by using suitable statistical methods, such as frequency, percentage, mean, standard deviation and correlation analysis.

1) Frequency and percentage

Frequency and percentage was used for making simple comparisons. The frequency of the particular category was multiplied by hundred and divided by total number of respondents in the particular category to get percentage.

2) Arithmetic mean

Arithmetic mean was calculated by sum of all the individuals scores and dividing it by the number of cases.

$$\text{Mean} = \frac{\sum Xi}{N}$$

Where,

$\sum Xi$ = Sum of respondents score.

N = Number of respondents.

3) Standard deviation

It was calculated by using following formula

$$\sigma = \sqrt{\frac{\sum (Xi - \bar{X})^2}{n}}$$

Where,

σ = Standard deviation

$\bar{X}$ = Mean

n = No. of respondents

Xi = Individual score of the i^{th} respondent

4) Correlation coefficient

To test the relationship between independent variable and dependent variables, the correlation method was employed using Karl Pearson's correlation coefficient. The data was computerized and correlation coefficient 'r' value was obtained, the formula used for 'r' is given as follows.

$$r = \frac{\sum (X_i - \bar{X})(Y_i - \bar{Y})}{\sqrt{\sum (X_i - \bar{X})^2 \times \sum (Y_i - \bar{Y})^2}}$$

Where,

r = Coefficient of correlation

x = Score in independent Variable

y = Score of dependent Variable

$\bar{x}$ = Mean of independent Variable

$\bar{y}$ = Mean of dependent Variable

3.10 Definitions of terms and concepts

- **Age:** Age is the number of completed years by the respondent farmers at the time of collection of data.
- **Education:** Education is defined as the number of years of formal education successfully completed by the respondent farmers.
- **Farming experience:** It refers the number of years the respondents were actively engaged and involved in farming activity
- **Annual income:** It refers to the gross income of family members in terms of rupees from all sources in a year.
- **Land holding:** It refers to the number of hectares of land owned by the respondents at the time of investigation.
- **Social participation:** It refers to the participation of the respondents in various formal and informal organizations in their locality.
- **Source of information:** Source of Information used by farmers to obtain information about *Panchsutri* technology of *rabi* sorghum.
- **Knowledge:** Factual information possessed by the farmers about *Panchsutri* technology of *rabi* sorghum.

- **Adoption:** It is a process by which respondents pass from first knowledge of *Panchsutri* technology to a decision to adopt or reject the technology.
- **Constraints:** It refers to the barriers or problems faced by the respondent farmers in adoption of *Panchsutri* technology.
- **Suggestions:** Suggestions are the probable solutions mentioned by the respondent farmers to overcome the constraints faced during adoption of *Panchsutri* technology in *rabi* sorghum.

CHAPTER IV

RESULTS AND DISCUSSION

The chapter 'Results and Discussion' deals with the results from the present investigation. The results are arranged after subjecting the data to statistical analysis. The data collected for the study have been analyzed and results are presented under following major heads:

- 4.1 Socio-personal characteristics of farmers
- 4.2 Economical characteristics of the farmers
- 4.3 Communicational characteristics of the farmers
- 4.4 Knowledge of farmers about *Panchsutri* technology of *rabi* sorghum
- 4.5 Adoption of *Panchsutri* technology of *rabi* sorghum by farmers
- 4.6 Relationship of socio-personal, economical and communicational characteristics with knowledge and adoption
- 4.7 Problems faced by the farmers in adoption of *Panchsutri* technology in *rabi* sorghum and their suggestions.

4.1 Socio-personal characteristics of farmers

4.1.1 Age

Age is the number of completed years by the respondents at the time of data collection. Here the chronological age of the respondents at the time of interview was taken into consideration. The distribution of the respondents according to their age is presented in Table 6.

Table 6. Distribution of the respondents according to their age

Sl. No.	Age	Respondents (N= 120)	
		Frequency	Percentage
1	Young (up to 38 years)	22	18.33
2	Middle (39 to 55 years)	76	63.34
3	Old (56 and above years)	22	18.33
Total		120	100.00
Mean = 46.77		SD = 8.96	

Table 6 revealed that about two third (63.34 per cent) of the respondents were from middle age group. While, 18.33 per cent of the respondents belonged to the young age group and 18.33 per cent belonged to old age group.

From the above findings it can be concluded that the majority of the respondents belonged to middle age group. Therefore, it can be said that agriculture in both the areas was looked after by the experienced and matured farmers.

The findings are in line with the findings of Damre (2013).

4.1.2 Education

Education is the number of years of formal education successfully completed by the farmers at the time of data collection. Formal education enhances comprehensibility and skill of an individual. An educated individual is more prone to analysis the cause and effect relationship of different phenomena. This also leads to improving skill of an individual in problem solving. The information regarding education of the respondents is presented in Table 7.

The data projected in table 7 revealed that 31.66 per cent respondents were educated up to primary level of

education while, 23.34 per cent were educated up to secondary level of education. It also revealed that 21.66 per cent, 15.00 per cent and only 8.34 per cent of the respondents were educated up to higher secondary level, illiterate and graduate and above level of education, respectively. It is a good sign that educated people are engaged in agriculture field. It is a known fact that the educated people have a broader view, more receptive and always in search for new information and technologies. Therefore, they easily accept and adopt new technology than other.

The findings are in the line with the findings of Patil (2002), Singh *et al.* (2014).

Table 7. Distribution of the respondents according to their education

Sl. No.	Education	Respondents (N=120)	
		Frequency	Percentage
1	Illiterate (having no formal education)	18	15.00
2	Primary education (1 st to 7 th standard)	38	31.66
3	Secondary education (8 th to 10 th standard)	28	23.34
4	Higher Secondary education (11 th to 12 th standard)	26	21.66
5	Graduate and post Graduate (13 th and above)	10	8.34
Total		120	100.00

4.1.3 Social Participation

It is defined as involvement of respondents in formal and informal organization in the village and nearby at his or her locality. Social participation brings an individual in close contact with other members of the social organization. This can provides an opportunity to exchange ideas, information and experiences. Social participation enhances the contact of the respondents which enables them to increase their level of adoption and finally leads to success of any production technology. The distribution of respondents according to their level of social participation is given in Table 8.

Table 8. Distribution of respondents according to their level of social participation

Sl. No.	Social Participation (Scores)	Respondents (N=120)	
		Frequency	Percentage
1	Low (up to 6)	37	30.84
2	Medium (7 to 10)	60	50.00
3	High (11 and above)	23	19.16
Total		120	100.00
Mean = 28.51		SD = 9.83	

The table 8 revealed that one half (50.00 per cent) of the respondents had medium level of social participation, followed by 30.84 per cent and 19.16 per cent of the respondents had low and high level of social participation, respectively.

From the above table it is inferred that most of respondents had medium level of social participation helps the respondents to be in touch with the various ongoing programme and projects of government and allied line departments.

The findings are similar with the findings of Zote (2001), Bainade (2005), and Wankhede (2008).

The frequency-wise social participation presented in three point continuum i.e. regular, occasional and never social participation. The nature of social participation in different social organizations and institutes is presented in Table 9.

Table 9. Distribution of the respondents according to their nature of social participation in different social organizations

Sl. No.	Organization	Attendance to meeting			
		Member/Office bearer	Regular	Occasional	Never
1	Grampanchayat	12 (10.00)	11 (9.17)	1 (0.83)	0 (0.00)
2	Co-operative sugar factory	16 (13.33)	10 (8.33)	6 (5.00)	0 (0.00)
3	Co-operative society	64 (53.33)	22 (18.33)	38 (31.67)	4 (3.33)
4	Co-operative Bank	7 (5.82)	5 (4.16)	1 (0.83)	1 (0.83)
5	Buying selling union	8 (6.66)	4 (3.33)	4 (3.33)	0 (0.00)
6	Agri. Produce Market Committee	4 (3.32)	2 (1.66)	2 (1.66)	0 (0.83)
7	Farmer Scientist Forum	26 (21.66)	23 (19.17)	2 (1.66)	1 (0.83)
8	Farmers club	29 (24.16)	24 (20.00)	5 (4.16)	0 (0.00)
9	Bhajni mandal	58 (48.33)	20 (16.66)	38 (31.67)	0 (0.00)
10	Any other	46 (38.33)	36 (30.00)	8 (6.66)	2 (1.67)

(Figures in the parentheses indicate percentages)

It was observed from Table 9 that, 53.33 per cent of the respondents were members or office bearers in co-operative society, followed by *bhajani mandal* (48.33 per cent), other organizations (38.33 per cent) and farmers club (24.16 per cent). Therefore, it can be concluded that the participation in co-operative society is comparatively more.

4.1.4 Farming experience

It denotes the number of years the respondents were actively engaged and involved in farming activity at the time of data collection and was taken into consideration in round years. The findings about the farming experience are shown in Table 10.

Table 10. Distribution of the respondents according to their farming experience

Sl. No.	Farming Experience (in years)	Respondents (n=120)	
		Frequency	Percentage
1	Less (up to 19)	20	16.66
2	Moderate (20 to 37)	75	62.50
3	More (38 and above)	25	20.84
Total		120	100.00
Mean = 28.51 SD = 9.83			

It is revealed from Table 10 that about two third (62.50 per cent) of farmers had moderate farming experience, followed by farmers had more farming experience (20.84 per cent) and farmers had less farming experience (16.66 per cent).

The findings are in line with the findings of Dalvi (2009) and Lad (2013).

4.2 Economic characteristics of the farmers

4.2.1 Annual income

The total annual income of the respondent and his family in rupees, received from all the sources in a year was considered. Annual income is a major determinant of the economic status of an individual. Better financial position of an individual provides him a chance to take risks, in trying out improved crop production technology. He can also afford, to spend more

on items required in connection with the new farming techniques. The data pertaining to the annual income of the respondents is presented in Table 11.

Table 11 revealed that a large majority (79.17 per cent) of the respondents had medium level of annual income. Only 8.33 per cent respondents had low annual income and remaining 12.50 per cent of respondents had high annual income.

Table 11. Distribution of respondents according to their annual income

Sl. No.	Annual Income (Rs.)	Respondents (N=120)	
		Frequency	Percentage
1	Low (up to Rs. 64,762)	10	8.33
2	Medium (Rs.64,763 to Rs. 2,56,257)	95	79.17
3	High (Rs. 2,56,258 and above)	15	12.50
Total		120	100.00
Mean = Rs.1,60,510.20 SD = Rs.95,747.81			

It is concluded from these findings that most of the respondents have medium level of annual income. Better financial position of an individual provides him a chance to take risks, in trying out improved crop production technology. But, low level of annual income hinders acquisitions of new skills and knowledge of new technology.

The findings are in line with the findings of Zote (2001), Nalini(2005), Sawant(2006), Deshmukh *et al.*(2007) and Chahande (2012).

4.2.2 Land holding

Land holding denotes the number of hectares of land owned by the respondents and his family as a whole. Here size of the land holding was measured in terms of number of hectares of land possessed and operated by farmers. The data pertaining to the land holding of the respondents is presented in Table 12.

Table 12. Distribution of farmers according to their size of landholding

Sl. No.	Size of Land holding	Respondents(120)	
		Frequency	Percentage
1.	Marginal farmers (up to 1 ha)	8	6.66
2.	Small farmers (1.01 to 2ha)	59	49.17
3.	Semi-medium farmers (2.01 to 4 ha)	41	34.17
4.	Medium farmers (4.01 to 10 ha)	12	10.00
5.	Big farmers(10.01ha and above)	00	00.00
Total		120	100.00

As regards the land holding of the farmers it is observed from Table 12 that 49.17 per cent of farmers were small farmers, followed by (34.17 per cent) semi-medium land holders, 10.00 per cent of the farmers had medium land holding and only 6.66 per cent of the farmers had marginal land holding and no one was having big land holding.

The findings are in line with the findings of Khuspe(2012).

From the findings, it can be concluded that nearly half of the respondents had small size of land holding. This land holding is not too large to manage or too small, to afford family needs. Medium size of land holding is manageable and the respondents can adopt new technologies or improved practices for increasing the level of productivity.

4.3 Communicational characteristics of the farmers

4.3 Source of information

It refers to various information source, communication channels used by the respondents for getting information regarding new technologies. In this study, source of information refers to the frequency of contact or exposure of the respondent to different information sources for obtaining the information on *Panchsutri* sorghum production technology. The extent of use of information sources is measured by taking into consideration all the possible sources available to the respondent like personal localite, personal cosmopolite, extension education methods and mass media. The distribution of farmers according to their extent of use of sources of information is presented in Table 13.

Table 13. Distribution of respondents according to their source of information

Sl. No.	Source of Information (Score)	Respondents (N=120)	
		Frequency	Percentage
1	Low (Up to 39)	20	16.66
2	Medium (40 to 84)	81	67.50
3	High (85 and above)	19	15.84
Total		120	100.00
Mean = 62.04 SD = 22.93			

From the Table 13 it can be revealed that majority (67.50 per cent) of the respondents were using source of information to medium extent, whereas 16.66 per cent and 15.84 per cent respondents had used sources of information to low and high extent, respectively.

Majority of the respondents belongs to group having medium level of sources of information. It may be due to respondents had medium social participation, medium income level and education.

The findings are consistent with the observations made by Pawar (2008) and Chahande (2012).

4.3.1 Personal localite source of information

Here it referred to the frequency of contact or exposure of the respondent to local personnel's such as friends, neighbours, relatives, progressive farmers, local leaders and Agro Service Centres for obtaining the information. The distribution of the respondents according to their extent of use of personal localite source of information is given in Table 14.

Table 14. Distribution of respondents according to their extent of use of personal localite source of information

Sl. No.	Personal localite source of information(score)	Respondents (N=120)	
		Frequency	Percentage
1	Low (Up to 12)	22	18.33
2	Medium (13 to 24)	72	60.00
3	High (25 and above)	26	21.67
Total		120	100.00
Mean = 18.76 SD = 6.51			

From the Table 14 it can be revealed that majority (60.00 per cent) of the respondents had used personal localite source of information to medium extent, followed by high (21.67 per cent) and low extent (18.33 per cent).

From this it can be concluded that majority of the respondents had medium level of use of personal localite sources of information.

The findings are in line with findings of Jalak(2002) and Patil (2015).

The frequency-wise distribution of respondents according to different personal localite sources of information is given in Table 15.

Table 15. Distribution of the respondents according to use of personal localite source of information

Sl. No.	Source	Respondents (N=120)					
		Once in week	Once in fortnight	Once in month	Once in season	Once in year	Never
1.	Friends	72 (60.00)	16 (13.34)	10 (8.33)	13 (10.84)	1 (0.83)	8 (6.66)
2.	Neighbours	66 (55.00)	13 (10.84)	16 (13.34)	10 (8.33)	4 (3.33)	11 (9.16)
3.	Relatives	47 (39.17)	10 (8.33)	44 (36.66)	5 (4.18)	4 (3.33)	10 (8.33)
4.	Progressive farmers	49 (40.84)	8 (6.66)	41 (34.17)	6 (5.00)	3 (2.50)	13 (10.83)
5.	Local Leaders	15 (12.50)	7 (5.84)	20 (16.66)	12 (10.00)	8 (6.66)	58 (48.34)
6.	Agro Service Centres	12 (10.00)	14 (11.66)	28 (23.35)	52 (43.33)	4 (3.33)	10 (8.33)

(Figures in the parentheses indicate percentages)

From the table 15, it was observed that friends are the major source of information to respondents. 60.00 per cent respondents seek information once in week from friends, followed by neighbours (55.00 per cent), progressive farmers (40.84 per cent) and relatives (39.17per cent). While considering local leaders, it was observed that 48.34 per cent of respondents never contacted the local leaders for seek agriculture information. From table 15, it is depicted that agro service centre was also one of the important sources of information where he trust more and visited.

4.3.2 Personal cosmopolite source of information

Here it referred to the frequency of contact or exposure of the respondent to extension personnel from Agriculture Department, *Panchayat Samiti*, Agricultural Universities, Agricultural Research Stations and Krishi Vigyan Kendras for obtaining the information. The distribution of the respondents according to their extent of use of personal cosmopolite source of information is given in Table 16

. From the Table 16 it can be revealed that majority (64.17 per cent) of the respondents had used personal cosmopolite source of information to medium extent, followed by low (18.33 per cent) and high extent (17.50 per cent).

Table 16. Distribution of respondents according to their extent of use of personal cosmopolite source of information

Sl. No.	Personal cosmopolite sources of information(score)	Respondents (N=120)	
		Frequency	Percentage
1	Low (Up to 6)	22	18.33
2	Medium (7 to 26)	77	64.17
3	High (27 and above)	21	17.50
Total		120	100.00
Mean = 16.55 SD = 10.10			

From this it can be concluded that majority of the respondents had medium level of use of personal cosmopolite sources of information.

The findings are similar to the findings of Patil (2015).

The distribution of respondents as per their use of personal cosmopolite sources of information is given in Table 17.

Table 17. Distribution of the respondents according to their use of personal cosmopolite source of information

Sl. No.	Source	Respondents (N=120)					
		Once in week	Once in fortnight	Once in month	Once in season	Once in year	Never
1.	Agril. Assistant	14 (11.66)	9 (7.51)	73 (60.84)	15 (12.50)	1 (0.83)	8 (6.66)
2.	Agril. Supervisor	10 (8.33)	9 (7.51)	64 (53.34)	10 (8.33)	4 (3.33)	23 (19.16)
3.	Taluka Agriculture Officer	6 (5.00)	8 (6.66)	44 (36.66)	8 (6.66)	5 (4.16)	49 (40.86)
4.	Sub Divisional Agril. Officer	0 (0.00)	3 (2.50)	13 (10.84)	6 (5.00)	3 (2.50)	95 (79.16)
5.	Superintending Agril. Officer	0 (0.00)	1 (0.83)	4 (3.33)	4 (3.33)	8 (6.66)	103 (85.85)
6.	Gramsevak	52 (43.33)	14 (11.66)	28 (23.35)	12 (10.00)	4 (3.33)	10 (8.33)
7.	University Scientist	15 (12.50)	12 (10.00)	16 (13.34)	18 (15.00)	12 (10.00)	47 (39.16)
8.	KVK Experts	2 (1.66)	4 (3.33)	5 (4.16)	40 (33.34)	23 (19.17)	46 (38.34)

(Figures in the parentheses indicate percentages)

It is evident from Table 17 that the majority (60.84 per cent) of the respondents obtained information from Agriculture Assistant 'once in month' and 53.34 per cent respondents contacted Agriculture supervisor 'once in month'. While large majority respondents never contacted with District Superintending Agricultural Officer (85.85 per cent) and Sub Divisional Agricultural Officer (79.16 per cent) for getting information. Scientists from Agricultural universities were contacted by 12.50 per cent respondents 'once in a week' and 38.34 per cent of respondents never contacted with KVK experts.

4.3.3 Extension Education methods as source of information

Here it referred to the frequency of contact or exposure of the respondent to Group discussion, Demonstration, *Shivarpheri*, Farmers rallies, Exhibitions and Study tours for

obtaining the information. The distribution of the respondents according to their extent of use of extension education methods as source of information is given in Table 18.

Table 18. Distribution of respondents according to their extent of use of extension education methods as source of information

Sl. No.	Extension Education methods (score)	Respondents (N=120)	
		Frequency	Percentage
1	Low (Up to 5)	21	17.50
2	Medium (6 to 12)	72	60.00
3	High (13 and above)	27	22.50
Total		120	100.00
Mean = 9.35		SD = 4.06	

From the Table 18 it can be revealed that majority (60.00 per cent) of the respondents had used extension education methods as source of information to medium extent, followed by high (22.50 per cent) and low extent (17.50 per cent). From this it can be concluded that majority of the respondents had medium level of use of extension education methods as sources of information.

The findings are in line with the findings of Patil (2015).

The distribution of the respondents as per their use of different extension education methods for obtaining the agriculture information is given in Table 19.

Table 19. Distribution of the respondents according to use of extension education methods

Sl. No.	Source	Respondents (N=120)					
		Once in week	Once in fortnight	Once in month	Once in season	Once in Year	Never
1.	Group discussion	16 (13.33)	14 (11.66)	42 (35.00)	28 (23.33)	11 (9.17)	9 (7.51)
2.	Demonstration	0 (0.00)	0 (0.00)	8 (6.66)	36 (30.00)	26 (21.67)	50 (41.67)
3.	Shivar pheri	0 (0.00)	2 (1.66)	3 (2.50)	44 (36.67)	18 (15.00)	53 (44.17)
4.	Farmers rallies	0 (0.00)	0 (0.00)	1 (0.83)	4 (3.33)	59 (49.18)	56 (46.48)
5.	Exhibitions	0 (0.00)	0 (0.00)	0 (0.00)	8 (6.66)	92 (76.68)	20 (16.66)
6.	Study tours	0 (0.00)	0 (0.00)	0 (0.00)	6 (5.00)	56 (46.66)	58 (48.34)

(Figures in the parentheses indicate percentages)

From the table 19 it is concluded that the two third 76.68 per cent) of the respondents obtained information from Exhibitions ‘once in year’ and nearly one half (49.18 per cent) respondents obtained information through farmer rallies ‘once in year’. While 48.34 per cent respondents never went on study tours and 46.48 per cent respondents never attended farmer rallies for getting information.

4.3.4 Mass media as source of Information

Here it referred to the frequency of contact or exposure of the respondent to electronic media such as radio, television, internet, CDs/DVDs and mobile and to print media such as newspapers, leaflets/folders, farm magazine, *Shri Sugi* , *Krishidarshani* and others. The distribution of the respondents according to their extent of use of mass media as source of information is given in Table 20.

From the Table 20 it can be revealed that more than two third (67.50 per cent) of the respondents had used mass media as source of information to medium extent, followed by low extent (20.83 per cent) and high extent (11.67 per cent). From

this it can be concluded that majority of the respondents had medium level of use of mass media as sources of information.

Table 20. Distribution of respondents according to their extent of use of mass media as source of information

Sl. No.	Mass media source (score)	Respondents (N=120)	
		Frequency	Percentage
1	Low (Up to 12)	25	20.83
2	Medium (13 to 23)	81	67.50
3	High (24 and above)	14	11.67
Total		120	100.00
Mean = 17.66		SD = 12.75	

The findings are in line with the findings of Sabi *et al.* (2014).

The distribution of the respondents as per their use of different electronic media for obtaining the agriculture information is given in Table 21.

From the Table 21 it can be revealed that more than three fourth (76.67 per cent) of the respondents had viewed television daily for acquiring information, followed by mobile (56.67 per cent). Majority of the respondents (98.34 per cent) never used CDs/DVDs for obtaining information followed by internet (81.68 per cent). Thus, it can be concluded that majority of the respondents had medium used television, mobile for obtaining information.

Table 21. Distribution of the respondents according to their extent of use of electronic media

Sl. No.	Frequency of use	Source				
		Radio	Television	Internet	CDs/DVDs	Mobile
1.	Always/Daily	52 (43.33)	92 (76.67)	14 (11.66)	0 (0.00)	68 (56.67)
2.	Four times in a week	18 (15.00)	8 (6.66)	6 (5.00)	0 (0.00)	14 (11.66)
3.	Once in a week	12 (10.00)	3 (2.50)	2 (1.66)	0 (0.00)	8 (6.66)
4.	Fortnight	7 (5.83)	1 (0.83)	0 (0.00)	0 (0.00)	3 (2.50)
5.	Monthly	0 (0.00)	0 (0.00)	0 (0.00)	2 (1.66)	2 (1.66)
6.	Never	31 (25.84)	16 (13.34)	98 (81.68)	118 (98.34)	25 (20.85)
	Total	120 (100.0)	120 (100.0)	120 (100.0)	120 (100.0)	120 (100.0)

(Figures in the parentheses indicate percentages)

The distribution of the respondents as per their use of different electronic media for obtaining the agriculture information is given in Table 22.

Table 22. Distribution of the respondents according to their extent of use of print media

Sl. No.	Frequency of use	Source				
		Newspapers	Leaflets / Folders	Farm Magazine	Shri Sugi	Krishidarshani
1.	Always/Daily	58 (48.34)	8 (6.66)	11 (9.16)	8 (6.66)	8 (6.66)
2.	Frequently	18 (15.00)	18 (15.00)	15 (12.50)	12 (10.00)	14 (11.66)
3.	Occasionally	10 (8.33)	18 (15.00)	12 (10.00)	14 (11.66)	16 (13.34)
4.	Rarely	7 (5.83)	11 (9.17)	12 (10.00)	7 (5.83)	18 (15.00)
5.	Never	27 (22.50)	65 (54.17)	70 (58.34)	79 (65.85)	64 (53.34)
	Total	120 (100.0)	120 (100.0)	120 (100.0)	120 (100.0)	120 (100.0)

(Figures in the parentheses indicate percentages)

From the Table 22 it can be revealed that near about one half 48.34 per cent) of the respondents were reading newspaper daily. Majority of the respondents (65.85 per cent) not read the university publication 'Shri Sugi' and 'Krishidarshani' (53.34 per cent).

4.4 Knowledge of farmers about *Panchsutri* technology in *rabi* sorghum

4.4.1 Overall Knowledge level about *Panchsutri* technology

Knowledge as a body of information possessed by individual. An individual gains or increases his knowledge through communication. For the purpose of this study, it was defined as factual information possessed by the farmers about *Panchsutri* technology in *rabi* sorghum. The distribution of the respondents according to their knowledge about *Panchsutri* technology is given in Table 23.

Table 23. Distribution of respondents according to their knowledge level

Sl.No.	Knowledge (Score)	Level	Respondents (N=120)	
			Frequency	Percentage
1	Low (Up to 11)		24	20.00
2	Medium (12 to 19)		65	54.16
3	High (20 and above)		31	25.84
	Total		120	100
Mean = 15.92			SD = 4.44	

The above Table 23 revealed that more than half of (54.16 per cent) respondents had medium level of knowledge. While 25.84 per cent had high level of knowledge and 20.00 per cent had low level of knowledge about *Panchsutri* production technology of *rabi* sorghum.

Therefore, it is seen that there is a wider gap between the expected and existing knowledge level about the *Panchsutri* technology of the respondents. Therefore attention of the state department of agriculture and SAU's need to be diverted on this aspect. Necessary steps like demonstrations, publicity should be taken to enhance the knowledge level so that it ultimately affects the adoption level of *Panchsutri* technology.

These findings are similar with the findings of Zote (2001) and Yadav *et al.*(2007).

4.4.2 Practice wise knowledge of respondents about *Panchsutri* technology

Mahatma Phule Krishi Vidyapeeth, Rahuri recommended five point production technology i.e. *Panchsutri* for rabi sorghum production.

Panchsutri consist important practices viz. soil moisture conservation practices before sowing, use of improved varieties as per soil type, soil moisture conservation practices after sowing, nutrient management and plant protection.

The practice wise knowledge of respondent about *Panchsutri* is given below.

4.4.2.1 Knowledge of soil moisture conservation practice before sowing

Conservation of soil moisture is a very important and basic point of *Panchsutri* production technology. It consist of ploughing, harrowing, preparation of beds and mulching. The data regarding knowledge of farmers about soil moisture conservation practice before sowing is given in table 24.

Table 24. Distribution of respondents as per their knowledge level about soil moisture conservation practice before sowing

Sl. No .	Recommended practices of <i>rabi</i> sorghum	Complete Knowledge		No Knowledge	
		Frequency	Percentage	Frequency	Percentage
1	Ploughing	120	100.00	00	00.00
2	Harrowing	120	100.00	00	00.00
3	Preparation of beds	78	65.00	42	35.00
4	Mulching	48	40.00	72	60.00

The data revealed in Table 24 that, all most all the respondents had complete knowledge of ploughing and harrowing. At the same, 65.00 per cent of the respondents had knowledge about preparation of beds and 40.00 per cent of the respondents had knowledge of mulching to conserve the available soil moisture.

4.4.2.2 Knowledge level about sowing

MPKV, Rahuri had developed improved varieties of *rabi* sorghum. It had also recommended the sowing time, seed treatment, spacing and seed rate for increasing the productivity of *rabi* sorghum. The data regarding knowledge level about sowing is given in table 25.

It was observed from Table 25 that, that, 64.16 per cent farmers had knowledge about the improved varieties of the *rabi* sorghum, 85.00 of the respondents had complete knowledge about proper sowing time, 67.50 per cent of the respondents had knowledge of seed rate, seed treatment of Sulphar (4gm/kg.) + Azatobacter(25g /kg.) was known to 48.33 per cent of the

respondents, 53.33 per cent of the respondents were knowing about spacing.

Table 25. Distribution of respondents according to their knowledge level of use about sowing practices

Sl. No.	Recommended practices of <i>rabi</i> sorghum	Complete Knowledge		No Knowledge	
		Frequency	Percentage	Frequency	Percentage
1	Improved variety (Phule Vasudha, M-35-1, Phule Anuradha)	77	64.16	43	35.84
2	Sowing time (15Sep-15Oct.)	102	85.00	18	15.00
3	Seed treatment of Sulphar (4gm/kg.) + Azatobacter(25g /kg.)	58	48.33	62	51.67
4	Spacing (45 X 15 cm)	64	53.33	56	46.67
5	Seed rate (10 kg / ha.)	81	67.50	39	32.5

4.4.2.3 Knowledge about soil moisture conservation practice after sowing

Conservation of soil moisture is a very important and basic point of *Panchsutri* production technology. It consist of thinning, hoeing, weeding and water management. The data regarding knowledge of respondents about soil moisture conservation practice after sowing is given in table 26.

IT was observed from table 26 that in case of soil moisture conservation practices after sowing 93.33 per cent of respondents had knowledge about weeding while, 90.83 per cent and 86.66 per cent of the respondents had knowledge of hoeing

and water management, respectively. 59.16 per cent of the respondents had knowledge about thinning operation.

Table 26. Distribution of respondents as per the knowledge level about soil moisture conservation practices after sowing

Sl. No	Recommended practices of <i>rabi</i> sorghum	Complete Knowledge		No Knowledge	
		Frequency	Percentage	Frequency	Percentage
1	Thinning (12-15 DAS)	71	59.16	49	40.84
2	Hoeing 1 st (3 weeks after sowing), 2 nd (5 weeks after sowing), 3 rd (7 weeks after sowing)	109	90.83	11	9.17
3	Weeding (One or Two)	112	93.33	8	6.67
4	Water management (One time) (Two times)	104	86.66	16	13.34

4.4.2.4 Knowledge about nutrient management practices

Nutrient management is very important aspect of *Panchsutri* technology. It consist of application of organic matter (FYM) and application of recommended chemical fertilizer (NPK). The data regarding knowledge of respondents about nutrient management practices is given in table 27.

About the nutrient management of *rabi* sorghum, it was observed from Table 27 that, 61.66 per cent and 52.50 per cent of the respondents had knowledge about recommended dose of FYM and chemical fertilizer requirement (NPK), respectively.

Table 27. Distribution of respondents according to their knowledge level of nutrient management practices

Sl.No.	Recommended practices of <i>rabi</i> sorghum	Complete Knowledge		No Knowledge	
		Frequency	Percentage	Frequency	Percentage
1	Application of organic manure (FYM)	74	61.66	46	38.34
2	Application of recommended chemical fertilizer (NPK)	63	52.50	57	47.50

4.4.2.5 Knowledge about plant protection measures

Plant protection measures consist of use of insecticide and fungicide to prevent the crop from attack of insects, pests and diseases. The data regarding knowledge of respondents about plant protection measures is given in table 28.

Table 28. Distribution of respondents according to their knowledge level about plant protection measures

Sl. No.	Recommended practices of <i>rabi</i> sorghum	Complete Knowledge		No Knowledge	
		Frequency	Percentage	Frequency	Percentage
1	Insecticide	38	31.66	82	68.34
2	Fungicide	52	43.34	68	56.66

It was observed from table 28 that, 43.34 per cent and 31.66 per cent of the respondents had knowledge about the use of fungicide and insecticide, respectively. This may be due to that in case of sorghum respondents are not worried and given due importance to plant protection measures.

4.5 Adoption of *Panchsutri* technology in *rabi* sorghum by farmers

4.5.1 Overall adoption of *Panchsutri* technology

It is mental process through which an individual passes from first hearing about an innovation to final adoption. It is operationalized as a process by which respondent passes from first knowledge of *Panchsutri* technology to a decision to adopt or reject the technology. The distribution of the respondents according to their adoption about *Panchsutri* technology is given in Table 29.

The Table 29 revealed that more than half of (56.66 per cent) the respondents had medium level of adoption. While, 22.50 per cent had low level of adoption and 20.84 per cent had high level adoption of *Panchsutri* production technology in *rabi* sorghum.

Table 29. Distribution of respondents as per the adoption level about *rabi* sorghum *Panchsutri* technology

Sl. No.	Adoption Level (Score)	Respondents (N=120)	
		Frequency	Percentage
1	Low (Up to 19)	27	22.50
2	Medium (20 to 33)	68	56.66
3	High (34 and above)	25	20.84
	Total	120	100
Mean = 26.46		SD = 7.83	

Similar to knowledge gap there is a wider scope to enhance the adoption level of respondents and overall. Therefore, there is a need to conduct demonstrations and convert the farmers from awareness to adoption stage.

The findings are in line with the findings of Borse(2002), Kothari *et al.* (2006), Dandnaik (2009), Chahande (2012) and Lad (2013).

4.5.2 Practice wise adoption of respondents about *Panchsutri* technology

Mahatma Phule Krishi Vidyapeeth, Rahuri recommended five point production technology i.e. *Panchsutri* for rabi sorghum production.

Panchsutri consist important practices viz. soil moisture conservation practices before sowing, use of improved varieties as per soil type, soil moisture conservation practices after sowing, nutrient management and plant protection.

The practice wise adoption of respondents about *Panchsutri* is given as follows.

4.5.2.1 Adoption of soil moisture conservation practice before sowing

Conservation of soil moisture is a very important and basic point of *Panchsutri* production technology. It consist of ploughing, harrowing, preparation of beds and mulching. The data regarding adoption of farmers about soil moisture conservation practice before sowing is given in table 30.

From table 30 it is revealed that, 96.66 per cent of the respondents had completely adopted the Ploughing, 95.00 per cent of the respondents had completely adopted the harrowing, 18.33 per cent of the respondents had completely adopted the 'Preparation of bed' and 10.83 per cent of the respondents had completely adopted the mulching practice.

Table 30. Distribution of respondents as per the adoption level of soil moisture conservation practice before sowing

Sl. No	Recommended practices of <i>rabi</i> sorghum	Adoption					
		Complete		Partial		No	
		Freq.	Percent	Freq.	Percent	Freq.	Percent
1	Ploughing	116	96.66	0	00.00	4	3.34
2	Harrowing	114	95.00	0	00.00	6	5.00
3	Preparation of beds	22	18.33	51	42.50	47	39.17
4	Mulching	13	10.83	29	24.17	78	65.00

The low adoption of bed preparation and mulching was observed very less as compared to other. This is may be due to these practices are quite labour consuming and farmers may not completely aware about advantages of these practices.

4.5.2.2 Adoption about improved varieties as per the soil type

Mahatma Phule Krishi Vidyapeeth, Rahuri had developed improved varieties of *rabi* sorghum. It had also recommended the sowing time, seed treatment, spacing and seed rate for increasing the productivity of *rabi* sorghum. The data regarding adoption of respondents about improved varieties as per the soil type is given in table 31.

As far as use of improved varieties is concerned, it was observed from table 31 that, 43.34 per cent of the sorghum growers had fully adopted improved varieties, followed by partially adoption (23.33 per cent) while, 33.33 per cent of the sorghum growers used other varieties. This may be due to non availability of seed of recommended variety. As about proper sowing time, 77.50 per cent of the respondents timely sown the sorghum and 22.50 per cent did not followed proper sowing time. It may be due to early or late rainfall in particular region.

Table 31. Distribution of respondents according to their adoption level recommended sowing practices

Sl. No.	Recommended practices of <i>rabi</i> sorghum	Adoption					
		Complete		Partial		No	
		Freq.	Percent	Freq.	Percent	Freq.	Percent
1	Improved variety (Phule Vasudha, M-35-1, Phule Anuradha)	52	43.34	28	23.33	40	33.33
2	Sowing time (15Sep-15Oct.)	93	77.50	0	00.00	27	22.50
3	Seed treatment of Sulphar (4gm/kg.)+Azatobacter (25g /kg.)	19	15.83	73	60.84	28	23.33
4	Spacing (45 X 15 cm)	49	40.83	59	49.17	12	10.00
5	Seed rate (10 kg / ha.)	69	57.50	51	42.50	00	00

It was noticed that 23.33 per cent of the farmers not adopted seed treatment practices, while 60.84 per cent of the farmers treated seed with any one of the recommended treatment and only 15.83 per cent of the farmers treated the seed with Sulphar (4gm/kg.)+ Azatobacter (25g /kg.). In spacing while sowing 40.83 per cent of the respondents had sown at proper spacing, while 10.00 per cent of the respondents not followed spacing. Similarly, 57.50 per cent of the respondents used recommended seed rate. Other farmers used more seed than recommended for fodder purpose.

4.5.2.3 Adoption about soil moisture conservation practice after sowing

Conservation of soil moisture is a very important and basic point of *Panchsutri* production technology. It consist of thinning, hoeing, weeding and water management. The data regarding adoption of respondents about soil moisture

conservation practice after sowing is given in table 32. About one half (47.50 per cent) of the respondents partially adopted thinning practice, 15.83 per cent of the respondents adopted thinning practice to complete extent while 36.67 per cent of the respondents not followed thinning. Very large number of respondents not completely adopted thinning practice. This may because of farmers feel that it reduces the plant population and resulted in less fodder yield. In case of hoeing operation 40.00 per cent of the respondents adopted it fully, whereas 49.17 per cent of the respondents farmers adopted partially and 10.83 per cent of the respondents had not adopted hoeing operation.

Table 32. Distribution of respondents according to their adoption level of soil moisture conservation practice after sowing

Sl. No	Recommended practices of <i>rabi</i> sorghum	Adoption					
		Complete		Partial		No	
		Freq.	Percent	Freq.	Percent	Freq.	Percent
1	Thinning (12-15 DAS)	19	15.83	57	47.50	44	36.67
2	Hoeing 1 st (3 weeks after sowing), 2 nd (5 weeks after sowing), 3 rd (8 weeks after sowing)	48	40.00	59	49.17	13	10.83
3	Weeding	109	90.83	00	00.00	11	9.17
4	Water management (One time) (Two times)	24	20.00	62	51.66	34	28.34

Weeding followed by large majority (90.83 per cent) of the respondents to full extent, while it had not adopted by the 9.17 per cent of the respondents. As regards to the application of protective irrigations it was observed that 28.34 per cent of the respondents were not given protective irrigations while, only

20.00 per cent of the respondents had protective irrigation facility and 51.66 per cent of the respondents applied supplementary irrigations partially to their crop. Of course the irrigation is depends on the availability of water.

4.5.2.4 Adoption about nutrient management practices

Nutrient management is very important aspect of *Panchsutri* technology. It consist of application of organic matter (FYM) and application of recommended chemical fertilizer (NPK). The data regarding adoption of respondents about nutrient management practices is given in table 33.

Table 33. Distribution of respondents according to their adoption level of nutrient management practices

Sl. No.	Recommended practices of <i>rabi</i> sorghum	Adoption					
		Complete		Partial		No	
		Freq.	Percent	Freq.	Percent	Freq.	Percent
1	Application of organic manure (FYM)	53	44.16	52	43.34	15	12.50
2	Application of recommended chemical fertilizer (NPK)	39	32.50	58	48.33	23	19.17

As regards the application of organic manure data from table 33 revealed that 44.16 per cent of the respondents applied organic manure as per recommendation and partial adoption was done by 43.34 per cent of the respondents while, it had not adopted by the 12.50 per cent of the respondents. In case of chemical fertilizers, 48.33per cent of the respondents used the fertilizers in indiscriminate quantity, whereas 32.50 per cent of the respondents applied as per the recommendation of SAU and 19.17 per cent of the respondents not applied chemical fertilizers. This may be due to the rainfed farming.

4.5.2.5 Adoption about plant protection measures

Plant protection measures consist of use of insecticide and fungicide to prevent the crop from attack of insects, pests and diseases. The data regarding adoption of respondents about plant protection measures is given in table 34.

As regards the spraying of insecticide data revealed from table 34 that, 68.34 per cent of the respondents not used the insecticide, 21.66 per cent of the respondents used insecticide in indiscriminate quantity whereas, 10.00 per cent of the respondents used as per the recommendation. In case of application of fungicide 56.66 per cent of the respondents applied fungicide in indiscriminate quantity, 25.84 per cent of the respondents not used the fungicide whereas, 17.50 per cent of the respondents used the fungicide as per the recommendation.

Table 34. Distribution of respondents as per the adoption level of plant protection measures

Sl. No.	Recommended practices of <i>rabi</i> sorghum	Adoption					
		Complete		Partial		No	
		Freq.	Percent	Freq.	Percent	Freq.	Percent
1	Insecticide	12	10.00	26	21.66	82	68.34
2	Fungicide	21	17.50	68	56.66	31	25.84

4.6 Relationship of socio-personal, economic and communicational characteristics with knowledge and adoption

In the present investigation an attempt was made to find out the relationship between socio-personal, economical and communicational characteristics with their knowledge and

adoption of *Panchsutri* technology in *rabi* sorghum , for that coefficient of correlation (r) was worked out.

4.6.1 Relationship between socio-personal, economic and communicational characteristics with knowledge

The relationship between socio-personal, economical and communicational characteristics with knowledge level of respondents is worked out and presented in table 35.

Table 35. Relationship between socio-personal, economical and communicational characteristics with knowledge

Sl. No.	Category	Correlation coefficient 'r'
1	Age	-0.35884**
2	Education	0.680694**
3	Social participation	0.607563**
4	Farming experience	-0.3636**
5	Annual income	0.736259**
6	Land holding	0.583654**
7	Overall Source of Information	0.846187**
8	Personal localite source	0.680069**
9	Personal cosmopolite source	0.759347**
10	Extension education methods	0.567385**
11	Mass media source	0.763440**

Note:

* = Significant at 5 per cent level, ** = Significant at 1 per cent level

4.6.1.1 Age and knowledge

The correlation coefficient ($r = -0.35884$) indicates that the relationship between the age and knowledge of *Panchsutri* technology on respondent was negative but highly significant.

It is therefore, concluded that as the age of the respondents increased, there was a decrease in the knowledge, production level and income. This means young and middle aged

respondents achieved greater production and income than did the older ones. This might be due to the fact that, young person's are enthusiastic, creative, progressive in nature and adopt new technologies more frequently and easily.

These finding are in line with the findings of Singh *et al.* (2001).

4.6.1.2 Education and knowledge

The correlation coefficient ($r = 0.680694$) showed that there was a positive and highly significant relationship between the education and knowledge level of *Panchsutri* technology in *rabi* sorghum. This may be because education brings about desirable changes in the behaviour of knowledge, skill and attitude. Educated farmers have more exposure to modern techniques.

It is, therefore, concluded that higher the education, more was the knowledge level. They can read the relevant literature and grasp modern techniques of agriculture. All this might have resulted in higher correlation between knowledge level and education.

This finding shows conformity with the findings of Sawale (2011).

4.6.1.3 Social participation and knowledge

The correlation coefficient ($r = 0.607563$) indicated that the relationship between the social participation and knowledge of *Panchsutri* technology was positive and highly significant. It means that the knowledge level and income of respondents increased with increase in social participation.

It is obvious that social participation develops wider outlook of respondents leading to higher contact with outside

world. Thus gaining more knowledge which may enable to adopt the *Panchsutri* technology which leads to increase in yield and income of respondents.

These findings are in line with those of Bainade(2005).

4.6.1.4 Farming experience and knowledge

The correlation coefficient ($r=-0.3636$) indicated that there was negative and highly significant relationship between the farming experience and level of knowledge about *Panchsutri* technology.

These findings are in line with those of Bedre (2009).

4.6.1.5 Annual income and knowledge

The annual income of the respondents exhibited positive and highly significant($r =0.736259$) relationship with their knowledge of *Panchsutri* technology in *rabi* sorghum.

Annual income determines the economic status of the farmer. They could afford to spend timely money on purchase of critical inputs in desired quantity as and when required for recommended management practices. This indicates that higher the annual income more will be the knowledge of *Panchsutri* technology in *rabi* sorghum.

These findings are similar with the Zote(2001).

4.6.1.6 Land holding and knowledge

The correlation coefficient ($r =0.583654$) indicated that the relationship between the size of land holding and knowledge of *Panchsutri* technology was positive and statistically significant. It means that the knowledge level and income of respondents increased with increase in the size of land holding.

Farmers with large size of land holding have higher socio-economic status and have higher social participation. Because of larger size land holding and sound economic position, they are likely to take higher risks, accepts new ideas earlier and adopt modern technology on their farm.

Similar findings were recorded by Zote (2001).

4.6.1.7 Sources of information and knowledge

The correlation coefficient ($r = 0.846187$) indicated that there was positive and highly significant relationship between respondents sources of information and extent of knowledge level.

It revealed that with an increased use of sources of information by the respondents there was gain in the additional technical information of the respondents which leads them to increase knowledge level. Higher the exposure and contacts with various sources of information enriches the knowledge of respondents and also offers solutions to their problems which ultimately results into higher adoption by them.

This finding shows conformity with the findings of Badale (2007).

4.6.1.8 Personal localite source of information and knowledge

The correlation coefficient ($r = 0.680069$) indicated that there was positive and highly significant relationship between respondents personal localite source of information and extent of knowledge level.

It revealed that with an increased use of personal localite source of information by the respondents there was

gain in the additional technical information of the respondents which leads them to increase knowledge level. Higher the exposure and contacts with personal localite source of information enriches the knowledge of respondents and also offers solutions to their problems which ultimately results into higher adoption by them.

4.6.1.9 Personal cosmopolite source of information and knowledge

The correlation coefficient ($r = 0.759347$) indicated that there was positive and highly significant relationship between respondents personal cosmopolite source of information and extent of knowledge level.

It revealed that with an increased use of personal cosmopolite source of information by the respondents there was gain in the additional technical information of the respondents which leads them to increase knowledge level.

4.6.1.10 Extension education methods and knowledge

The correlation coefficient ($r = 0.567385$) indicated that there was positive and highly significant relationship between respondents use of extension education methods as a source of information and extent of knowledge level.

It revealed that with an increased use of extension education methods as a source of information by the respondents there was gain in the additional technical information of the respondents which leads them to increase knowledge level.

4.6.1.11 Mass media source of information and knowledge

The correlation coefficient ($r = 0.763440$) indicated that there was positive and highly significant relationship between

respondents mass media source of information and extent of knowledge level.

It revealed that with an increased use of mass media source of information by the respondents there was gain in the additional technical information of the respondents which leads them to increase knowledge level.

4.6.2 Relationship between socio-personal, economical and communicational characteristics with adoption

The relationship between socio-personal, economical and communicational characteristics with adoption level of respondents is worked out and presented in table 36.

Table 36. Relationship between socio-personal, economical and communicational characteristics with adoption

Sl. No.	Category	Correlation coefficient 'r'
1.	Age	-0.28769**
2.	Education	0.57801**
3	Social participation	0.57904**
4	Farming experience	-0.28502**
5	Annual income	0.71444**
6	Land holding	0.599025**
7	Sources of Information	0.756139**
8	Personal localite source	0.649884**
9	Personal cosmopolite source	0.723513**
10	Extension education methods	0.508872**
11	Mass media source	0.699733**

Note:

* = Significant at 5 per cent level, **= Significant at 1 per cent level

4.6.2.1 Age and adoption

The correlation coefficient ($r = -0.28769$) indicated that age of the respondent was negatively and highly significantly related to their adoption.

Similar finding was reported by Bahire (2011).

4.6.2.2 Education and adoption

The correlation coefficient ($r = 0.57801$) indicated that education of the respondent was positively and highly significantly related to their adoption. It is therefore concluded that higher the education more was the adoption as higher education brings about changes in farmers knowledge, skill and attitude.

Similar finding was reported by Lad (2013).

4.6.2.3 Social participation and adoption

The correlation coefficient ($r = 0.57904$) indicated that the relationship between the social participation and adoption of *Panchsutri* technology was positive and statistically significant. It means that the adoption level of respondents increased with increase in social participation.

It is obvious that social participation develops wider outlook of respondents leading to higher contact with outside world. Thus gaining more knowledge which may enable to adopt the *Panchsutri* technology which leads to increase in yield and income of respondents.

These finding are in line with the findings of Bainade (2005).

4.6.2.4 Farming experience and adoption

The correlation coefficient ($r = -0.28502$) indicated that there was negative and highly significant relationship between

the farming experience and level adoption about *Panchsutri* technology.

4.6.2.5 Annual income and adoption

The correlation coefficient ($r = 0.71444$) showed that the annual income of the respondents exhibited positive and highly significant relationship with their extent of adoption of *Panchsutri* technology.

Annual income determines the economic status of the farmer. They could afford to spend timely money on purchase of critical inputs in desired quantity as and when required for recommended management practices. This indicates that higher the annual income more will be the adoption of *Panchsutri* technology.

These findings are in line with the findings of Parhad (2002).

4.6.2.6 Land holding and adoption

There was a positive and highly significant correlation ($r=0.599025$) between size of land holding and adoption *Panchsutri* technology by the respondents.

Farmers with large size of land holding had higher socio-economic status. Because of optimum size of land holding and sound economic position they are ready to accept new ideas, technology and take sufficient risk on their farm. Therefore, the correlation between land holding and adoption was significant.

Similar findings were recorded by Bainade (2005).

4.6.2.7 Sources of information and adoption

The correlation coefficient ($r = 0.756139$) indicated that the relation between the sources of information used by the

respondents and extent of adoption level was positive and significant.

It revealed that with an increased use of sources of information by the respondents there was gain in the additional technical information of the respondents which leads them to increase adoption level. Higher the exposure and contacts with various sources of information enriches the knowledge of respondents and also offers solutions to their problems which ultimately results into higher adoption by them.

The findings are similar with the findings of Lad (2013).

4.6.2.8 Personal localite source of information and adoption

The correlation coefficient ($r = 0.649884$) indicated that the relation between the personal localite sources of information used by the respondents and extent of adoption level was positive and highly significant.

It revealed that with an increased use of sources of information by the respondents there was gain in the additional technical information of the respondents which leads them to increase adoption level.

4.6.2.9 Personal cosmopolite source of information and adoption

The correlation coefficient ($r = 0.723513$) indicated that the relation between the personal cosmopolite source of information used by the respondents and extent of adoption level was positive and highly significant.

It revealed that with an increased use of personal cosmopolite source of information by the respondents there

was gain in the additional technical information of the respondents which leads them to increase adoption level.

4.6.2.10 Extension education methods and adoption

The correlation coefficient ($r = 0.508872$) indicated that the use of extension education methods as a source of information by the respondent was positively and highly significantly related to their adoption.

4.6.2.11 Mass media as a source of information and adoption

The correlation coefficient ($r = 0.699733$) indicated that the use of mass media as a source of information by the respondent was positively and highly significantly related to their adoption.

It revealed that with an increased use of mass media as a source of information by the respondents there was gain in the additional technical information of the respondents which leads them to increase adoption level.

4.7 Constraints faced by the farmers in adoption of *Panchsutri* technology in *rabi* sorghum and their suggestions.

4.7.1 Constraints faced by the farmers in adoption of *Panchsutri* technology in *rabi* sorghum

One of the main objective of the present study was to study the constraints faced by the *rabi* sorghum growers in adoption of *Panchsutri* technology. Constraints are the circumstances or causes that prohibit and restraints the farmers in adoption of the tecnology. There are some farmers who are always ahead in adoption of certain innovations while other do not. The thrust of the present investigation was to

know why the sorghum growers do not adopt *Panchsutri* technology for increasing soil health and yield in sorghum and what are the constraints those prohibit them from adoption of *Panchsutri* technology are given in Table 37.

The data presented in Table 37 indicated that, 70.00 per cent of the sorghum growers faced the constraint of unavailability of water for supplementary irrigation to *rabi* sorghum. 68.33 per cent sorghum growers faced problem of lack of information about use of pesticides. 60.00 per cent farmers had lack of knowledge about mulching.

Other constraints reported by the farmers were lack of knowledge of use of fungicide (56.66 per cent), unavailability of *Sara yantra* for preparation of beds (54.16 per cent), lack of availability of quality seeds within time (52.50 per cent), lack of knowledge of seed treatment (51.67 per cent), lack of knowledge about improved tools and implements (50.00 per cent). 48.33 per cent sorghum growers faced the problem of difficulty in protection of grains from birds, 45.83 per cent of the respondents reported that, there was a high cost of fertilizers and 42.50 per cent of the respondent reported that, there was unavailability of labour at low cost.

Table 37. Constraints faced in adoption of *Panchsutri* technology in *rabi* sorghum

Sl. No.	Constraints	Respondents		
		Frequency	Per cent	Rank
1	Unavailability of water for irrigation	84	70.00	I
2.	Lack of information about use of pesticides	82	68.33	II
3.	Lack of knowledge about mulching	72	60.00	III
4.	Lack of knowledge of use of fungicide	68	56.66	IV
5.	Unavailability of <i>Sara yantra</i> for preparation of beds	65	54.16	V
6.	Lack of availability of quality seeds within a time	63	52.50	VI
7.	Lack of knowledge of seed treatment	62	51.67	VII
8.	Lack of knowledge about improved tools and implements	60	50.00	VIII
9.	Difficulty in protection of grains from birds	58	48.33	IX
10.	High cost of fertilizers	55	45.83	X
11.	Unavailability of labour at low cost	51	42.50	XI

4.7.2. Suggestions made by the respondent to overcome the constraints

Considering the constraints faced by the sorghum growers in adoption of *Panchsutri* technology the respondent's suggestions are presented in table 38.

The Table 38 revealed that more than two third (66.66 per cent) of the farmers suggested that, protective irrigation facility should be made available, Agriculture department, SAU's and KVK's should provide knowledge about use of pesticides reported by 65.83 per cent respondents followed by, government should provide loan and subsidies in time was the

Table 38. Suggestions made by the respondent to overcome the constraints

Sl. No.	Suggestion	Respondents (n=120)		
		Frequency	Percentage	Rank
1.	Protective irrigation facility should be made available	80	66.66	I
2.	Agriculture department ,SAU's and KVK's. should provide knowledge about use of pesticides.	79	65.83	II
3.	Government should provide loan and subsidies in time for digging farm pond, for purchasing implements.	74	61.66	III
4.	Training programmes on <i>Panchsutri</i> technology should be conducted by SAU's and KVK's.	63	52.50	IV
5.	Pre seasonal training and crop demonstration programme should be organized by Agriculture department.	59	49.16	V
6.	There should be availability of quality seeds of SAU in near by <i>Krishi Vigyan Kendra</i> and <i>Krishi Seva Kendra</i>	51	42.50	VI
7.	Supply of 'Agni ribbons' for protection of grains from birds by department of Agriculture	49	40.83	VII
8.	Cost of seeds, fertilizers and pesticides should be reduced or provide at subsidized rates	47	39.16	VIII
9.	Custom of hiring of <i>Sara</i> implements facility made available at village level	25	20.83	IX

suggestion reported by 61.66 per cent of the respondents. Training programmes on *Panchsutri* technology should be conducted by SAU's and KVK's was the fourth suggestion reported by 52.50 per cent of the respondents. Pre seasonal training and crop demonstrations programme should be organized by Agriculture department was the suggestion made by the nearly one half (49.16 per cent) of the respondents. 42.50 per cent respondents reported that, there should be availability of quality seeds in nearby *Krishi Vigyan Kendra* and *Krishi Seva Kendra*. 40.83 per cent of the respondents suggested that supply of 'Agni ribbon' for protection of crop from birds by agriculture department, 39.16 per cent of the respondents suggested that the cost of seeds, fertilizers and pesticides should be reduced. Custom of hiring of *Sara* implements facility should be made available at village level was the suggestion reported by 20.83 per cent of the respondents.

CHAPTER V

SUMMARY, CONCLUSION AND IMPLICATIONS

The results of the investigation of this study are summarized as below,

In India Sorghum is the fifth most important cereal crop in the world after wheat, rice, maize and barley. It is very hardy crop and can tolerate in adverse climatic conditions because of which it is cultivated on a large scale in an area having low rainfall.

Jowar is important crop grown in Rabi season particularly in Solapur district. It is short duration crop gives better income within short period hence preferred by most of the farmers. But due to uneven nature of rainfall the yield level of jowar crop is not satisfactory. Even though the improved technologies like *Panchsutri* technology are available with farmer. This is because of the lack of scientific knowledge of farmers to accept the new technology. This may be due to the different problems or constraints associated with the technology. Therefore to know the knowledge and adoption of *Panchsutri* technology the study is very much needed.

Considering these different aspects, the present study entitled, 'Knowledge and adoption *Panchsutri* technology in *rabi* sorghum' was undertaken with following specific objectives.

The specific objectives of the study were,

- 5.1 To study the personal, socio-economic characteristics of the sorghum growers.
- 5.2 To study the knowledge of the sorghum growers about *Panchsutri* technology for *rabi* sorghum.
- 5.3 To study the adoption of *rabi* sorghum *Panchsutri* technology by the sorghum growers.

- 5.4 To find out relationship between personal, socio-economic characteristics of sorghum growers with their knowledge and adoption of rabi sorghum *Panchsutri* technology.
- 5.5 To study the constraints faced by the sorghum growers in adoption of rabi sorghum *Panchsutri* technology and obtain their suggestions for overcoming the constraints.

Solapur district was selected for the present investigation because it has maximum area and production of *rabi sorghum* under cultivation in Maharashtra. Six villages were selected from Mangalvedha, Mohol and North Solapur tahasils.

The information relevant to the decided objectives was collected from 120 respondents from six villages. The data were gathered by specially designed interview schedule. The respondents were contacted personally for effective interview. In order to facilitate the analysis and interpretation of the data statistical tools like frequency, percentage, Karl Pearsons's coefficient of correlation and Standard Deviation were used. The salient features of the findings are summarized below.

5.1 Summary

The summary of important findings is given under the following

heads

- 5.1.1 Socio-personal characteristics of farmers
- 5.1.2 Economical characteristics of the farmers
- 5.1.3 Communicational characteristics of the farmers
- 5.1.4 Knowledge of farmers about *Panchsutri* technology in *rabi sorghum*
- 5.1.5 Adoption of farmers about *Panchsutri* technology in *rabi sorghum*

5.1.6 Relationship of socio-personal, economical and communicational characteristics with knowledge and adoption

5.1.7 Constraints faced by the farmers in adoption of *Panchsutri* technology in *rabi* sorghum and their suggestions.

5.1.1 Socio-personal characteristics of farmers

A.Age

Age-wise categorization of the respondents showed that, about two third (63.34 per cent) of the respondents were from middle age group. While, 18.33 per cent of the respondents belonged to the young age group and 18.33 per cent belonged to old age group, respectively.

B.Education

Education-wise categorization of the respondents showed that 31.66 per cent respondents were educated up to primary level of education while, 23.34 per cent were educated up to secondary level of education. It also revealed that 21.66 per cent, 15.00 per cent and only 8.34 per cent of the respondents were educated up to higher secondary level, illiterate and graduate and post graduate level of education, respectively.

C.Social participation

Social participation showed that one half (50.00 per cent) of the respondents had medium level of social participation, while 30.84 per cent and 19.16 per cent had low and high level of social participation respectively.

D.Farming experience

Farming experience showed that, about 62.50 per cent of farmers had moderate farming experience, followed by had more farming experience (20.84 per cent) and had less farming experience. (16.66 per cent).

5.1.2 Economical characteristics of the farmers

A. Annual income

It is observed that, a large majority (79.17 per cent) of the respondents had medium level of annual income whereas, 12.50 per cent of respondents had high annual income and only 8.33 per cent respondents had low annual income.

B. Land holding

As regards the land holding of the farmers it is observed that, 49.17 per cent of farmers were small farmers, followed by (34.17 per cent) semi-medium land holders, 10.00 per cent of the farmers had medium land holding and only 6.66 per cent of the farmers had marginal land holding and no one was having big land holding.

5.1.3 Communicational characteristics of the farmers

Source of information

Source of information showed that, majority (67.50 per cent) of the respondents were using of source of information to medium extent, whereas 16.66 per cent and 15.84 per cent respondents had used sources of information to low and high extent, respectively.

A. Personal localite source of information

It can be revealed that, majority (60.00 per cent) of the respondents had used personal localite source of information to medium extent, followed by high (21.67 per cent) and low extent (18.33 per cent).

B. Personal cosmopolite source of information

It can be revealed that majority (64.17 per cent) of the respondents had used personal cosmopolite source of information to medium extent, followed by low (18.33 per cent) and high extent (17.50 per cent).

C. Extension education methods as source of information

Extension education methods showed that, majority (60.00 per cent) of the respondents had used extension education methods as source of information to medium extent, followed by high (22.50 per cent) and low extent (17.50 per cent).

D. Mass media as a source of information

It can be revealed that about two third (67.50 per cent) of the respondents had used mass media as sources of information to medium extent, followed by low extent (20.83 per cent) and high extent (11.67 per cent).

5.1.4 Knowledge of farmers about *Panchsutri* technology in *rabi* sorghum

Overall knowledge level showed that, more than half of (54.16 per cent) respondents had medium level of knowledge about *Panchsutri* technology in *rabi* sorghum while, 25.84 per cent had high level of knowledge and 20.00 per cent had low level of knowledge.

5.1.5 Adoption of farmers about *Panchsutri* technology in *rabi* sorghum

Overall adoption level showed that, more than half of (56.66 per cent) the respondents had medium level of adoption while, 22.50 per cent had low level of adoption and 20.84 per cent had high level adoption.

5.1.6 Relationship of socio-personal, economical and communicational characteristics with knowledge and adoption

A. Age and knowledge

The correlation coefficient($r = -0.35884$) indicated that, the relationship between the age and knowledge of *Panchsutri*

technology by the respondent was negative but highly significant.

B. Education and knowledge

The correlation coefficient ($r = 0.680694$) showed that there was a positive and highly significant relationship between the education and knowledge level of *Panchsutri* technology in *rabi* sorghum.

C. Social participation and knowledge

The correlation coefficient ($r = 0.607563$) indicated that the relationship between the social participation and knowledge of *Panchsutri* technology was positive and highly significant.

D. Farming experience and knowledge

The correlation coefficient ($r = -0.3636$) indicated that there was negative and highly significant relationship between the farming experience and level of knowledge about *Panchsutri* technology.

E. Annual income and knowledge

The annual income of the respondents exhibited positive and highly significant ($r = 0.736259$) relationship with their knowledge of *Panchsutri* technology in *rabi* sorghum.

F. Land holding and knowledge

The correlation coefficient ($r = 0.583654$) indicated that the relationship between the size of land holding and knowledge of *Panchsutri* technology was positive and highly significant.

G. Source of information and knowledge

The correlation coefficient ($r = 0.846187$) indicated that there was positive and highly significant relationship between respondents sources of information and extent of knowledge level.

H. Personal localite source of information and knowledge

The correlation coefficient ($r = 0.680069$) indicated that there was positive and highly significant relationship between respondents personal localite source of information and extent of knowledge level.

I. Personal cosmopolite source of information and knowledge

The correlation coefficient ($r = 0.759347$) indicated that there was positive and highly significant relationship between respondents personal cosmopolite source of information and extent of knowledge level.

J. Extension education methods and knowledge

The correlation coefficient ($r = 0.567385$) indicated that there was positive and highly significant relationship between respondents use of extension education methods as a source of information and extent of knowledge level.

K. Mass media source of information and knowledge

The correlation coefficient ($r = 0.763440$) indicated that there was positive and highly significant relationship between respondents mass media source of information and extent of knowledge level.

L. Age and adoption

The correlation coefficient ($r = -0.28769$) indicated that age of the respondent was negatively and highly significantly related to their adoption.

M. Education and adoption

The correlation coefficient ($r = 0.57801$) indicated that education of the respondent was positively and highly significantly related to their adoption.

N. Social participation and adoption

The correlation coefficient ($r=0.57904$) indicated that the relationship between the social participation and adoption of *Panchsutri* technology was positive and statistically significant.

O. Farming experience and adoption

The correlation coefficient ($r= -0.28502$) indicated that there was negative and highly significant relationship between the farming experience and level adoption about *Panchsutri* technology.

P. Annual income and adoption

The correlation coefficient ($r=0.71444$) showed that the annual income of the respondents exhibited positive and highly significant relationship with their extent of adoption of *Panchsutri* technology.

Q. Land holding and adoption

There was a positive and highly significant correlation ($r=0.599025$) between size of land holding and adoption of *Panchsutri* technology by the respondents.

R. Source of information and adoption

The correlation coefficient ($r=0.756139$) indicated that the relation between the sources of information used by the respondents and extent of adoption level was positive and significant.

S. Personal localite source of information and adoption

The correlation coefficient ($r=0.649884$) indicated that the relation between the personal localite sources of information used by the respondents and extent of adoption level was positive and highly significant.

T. Personal cosmopolite source of information and adoption

The correlation coefficient ($r=0.723513$) indicated that the relation between the personal cosmopolite source of information used by the respondents and extent of adoption level was positive and highly significant.

U. Extension education methods and adoption

The correlation coefficient ($r=0.508872$) indicated that the use of extension education methods as a source of information by the respondent was positively and highly significantly related to their adoption.

V. Mass media as a source of information and adoption

The correlation coefficient ($r=0.699733$) indicated that the use of mass media as a source of information by the respondent was positively and highly significantly related to their adoption.

5.1.7 Constraints faced by the farmers in adoption of *Panchsutri* technology in *rabi* sorghum and their suggestions.

5.1.7.1 Constraints faced by the farmers in adoption of *Panchsutri* technology in *rabi* sorghum

It is observed that, 70.00 per cent of the sorghum growers faced the constraint of unavailability of water for supplementary irrigation to *rabi* sorghum. 68.33 per cent sorghum growers faced problem of lack of sufficient information about use of pesticide. 60.00 per cent farmers had lack of knowledge about mulching.

Other constraints reported by the farmers were lack of knowledge of use of fungicide (56.66 per cent), unavailability

of *Sara yantra* for preparation of beds (54.16 per cent), non-availability of timely quality seed as per soil type (52.50 per cent), lack of knowledge of seed treatment (51.67 per cent), lack of knowledge about improved tools and implements (50.00 per cent). 48.33 per cent sorghum growers faced the problem of difficulty in protection of crop from birds, 45.83 per cent of the respondents reported that, there was a high cost of fertilizers and 42.50 per cent of the respondents reported that, there was unavailability of labour at low cost.

5.1.7.2 Suggestions of the respondents to overcome the constraints

More than two third (66.66 per cent) of the farmers suggested that, there should be availability of water for irrigation. Agriculture department, SAU's and KVK's should provide knowledge about use of pesticides reported by 65.83 per cent respondents, followed by government should provide loan and subsidies in time' was the suggestion reported by 61.66 per cent of the respondents. Training programmes on *Panchsutri* technology should be conducted by SAU's and KVK's was the fourth suggestion reported by 52.50 per cent of the respondents.

Pre seasonal training and crop demonstrations programmes should be organized by Agriculture department was the suggestion made by the nearly one half (49.16 per cent) of the respondents. 42.50 per cent respondents reported that, there should be availability of quality seeds of SAU in nearby *Krishi Vigyan Kendra* and *Krishi Seva Kendra*. 40.83 per cent of the respondents suggested that supply of 'Agni ribbon' by agriculture department for protection of grains from birds, 39.16 per cent of the respondents suggested that the cost of

seeds, fertilizers and pesticides should be reduced. Custom hiring facility should be made available was the suggestion reported by 20.83 per cent of the respondents.

5.2 Conclusions

5.2.1 Socio-personal characteristics of farmers

Majority of the respondents belonged to middle age group. Therefore, it can be said that agriculture in both the areas was looked after by the experienced farmers. Majority of the respondent educated up to primary and secondary school level.

Most of respondents had medium level of social participation helps the respondents to be in touch with the government's various ongoing programme and projects. Majority of the respondents had moderate farming experience.

5.2.2 Economical characteristics of farmers

It can be concluded that most of the respondents have medium level of annual income. Low level of annual income hinders acquisitions of new skills and knowledge of new technology while, better financial position of an individual provides him a chance to take risks, in trying out improved crop production technology. It can also be concluded that nearly half of the respondents had small size of land holding.

5.2.3 Communicational characteristics of the farmers

Majority of the respondents belongs to group having medium level of sources of information. It may be due to present era of electronic media and mass media.

5.2.4 Knowledge of farmers about *Panchsutri* technology in *rabi* sorghum

It can be concluded that more than half of respondents had medium level of knowledge, followed by high level of knowledge and low level of knowledge.

5.2.5 Adoption of farmers about *Panchsutri* technology in *rabi* sorghum

It can be concluded that more than half of respondents had medium level of adoption, followed by low level of adoption and high level of adoption.

5.2.6 Relationship of socio-personal, economical and communicational characteristics with knowledge

It was concluded that, knowledge of the respondents about *Panchsutri* technology was increased with the increased level of education, social participation, annual income, land holding and information sources use because there was a positive and highly significant relationship in these and knowledge.

The age and farming experience showed a negative but highly significant relationship with knowledge of the respondents.

5.2.7 Relationship of socio-personal, economical and communicational characteristics with adoption

It was concluded that, adoption of the respondents about *Panchsutri* technology was increased with the increased level of education, social participation, annual income, land holding and information sources use because there was a positive and highly significant relationship in these and adoption.

The age and farming experience showed a negative but highly significant relationship with adoption of the respondents.

5.2.8 Constraints faced by the respondents in adoption of *Panchsutri* technology in *rabi* sorghum

The important constraints reported by majority respondents were, unavailability water, lack of information about use of pesticides, lack of knowledge about mulching.

Other constraints reported by the farmers were lack of knowledge of use of fungicide, unavailability of *Sara yantra* for preparation of beds, non-availability of timely quality seeds within a time, lack of knowledge of seed treatment, lack of knowledge about improved tools and implements, difficulty in protection of grains from birds, high cost of fertilizers and unavailability of labour at low cost.

5.2.9 Suggestions of respondents for overcoming the constraints

Respondents had made various suggestions to overcome the constraints, the suggestions were, protective irrigation facility should be made available. Agriculture department, SAU's and KVK's should provide knowledge about use of pesticides, government should provide loan and subsidies in time, Training programmes on *Panchsutri* technology should be conducted, Pre seasonal training and crop demonstrations programme should be organized by Agriculture department, there should be availability of quality seeds in near by *Krishi Vigyan Kendra* and *Krishi Seva Kendra*. Other suggestions were, supply of 'Agni ribbon' by Agriculture department for protection of grains from birds, the cost of seeds, fertilizers and pesticide should be reduced, Custom hiring facility should be made available at village level were the suggestions reported by the respondents.

5.3 Implications

Based on the findings and observations of the study, following implications are drawn for increasing the impact of harnessing opportunities for productivity enhancing project. Moreover, the results of study would be helpful to government in regards to the sorghum production.

5.3.1 Action implications

1. From results it was revealed that, knowledge and adoption were co-related with the productivity level. The *Panchsutri* technology played a significant role in bringing about desirable changes in the respondents. Therefore, this programme should be implemented on the large scale and should also be implemented for other crops.
2. Among the all agricultural inputs, irrigation availability is the major input in the agricultural sector. Therefore there is need to provide subsidies through State agriculture department for digging farm pond for applications of protective irrigation at proper growth stage of *rabi* sorghum.
3. The major problem was lack of knowledge about use of pesticide (68.33 per cent) and use of fungicide (56.66 per cent) to control various pests and diseases of *rabi* sorghum by respondents was observed in the study, therefore it is suggested that to overcome these problems more efforts need to be taken through SAUs, ATMA and KVK, which help to increase awareness, interest and knowledge of *rabi* sorghum growers towards improved cultivation practices and particularly about the pest and disease management.
4. From study it is observed that source of information is found to be positive and highly significant correlation with knowledge

(0.846187) and adoption (0.756139) of *Panchsutri* production technology. Therefore it is suggested that more emphasis should be given on publicity of rabi sorghum *Panchsutri* production technology through print and electronic media.

5. From the study it was also observed that farmers face the constraints regarding the unavailability of implements specially the *Sara Yantra* therefore, it is suggested that the Government should take initiative and promote the farmers for custom of hiring for implements.

5.3.2 Research implications

The present study is of exploratory type and therefore to judge its validity on large scale, similar studies on *Panchsutri* technology to the present need to be replicated in other areas.

The above conclusions have been drawn on the basis of one year study and also some other aspects remained untouched therefore, other aspects need to be studied to a greater depth, in future investigation. However, this study would be useful as guideline for further studies of similar type.

1. Various facts of characteristics of respondents have been changed due to adoption of *Panchsutri* technology. However, the characteristics other than those studied in present work need to be studied.
2. This study would also be useful as a 'benchmark' for further probe into the studies of similar type.
3. To cover wide ranging factors of human behaviour of the farmers in transfer of technology, further interdisciplinary research is necessary.

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×¾ÖÃÿÖÖ,ü ×¿ÖÖÖÖ ×¾Ö³ÖÖÖ

Öü¾μÖãÖ,ü 'ÖÆüÖ×¾ÖÖ»ÖμÖ

'ÖÆüÖÿ'ÖÖ ±ãú»Öê Öú×ÂÖ ×¾ÖÖÖÖßü, üÖÆãü,üß

×Ö»ÆüÖ : †Æü'Öü-ÖÖ,ü ('ÖÆüÖ,üÖÂ™Öü)

'Öã»ÖÖÖÿÖ -Ö¿;-ÖÖ¾Ö»Öß

Ö²ÖÖ-ÖúÖ"Öê -ÖÖÖ¾Ö

'ÖÖÖÖü;ÖÖú

ÁÖß.Öß.ÃÖ."Ö¾ÆüÖÖ

üÖð.ÃÖ.üß.ÖÖ™üß»Ö

Ö.ÃÖß (Öú×ÂÖ)

Ö-ÖÃÖÖ-ÖÖú †×-ÖúÖ,üß

×¾ÖÃÿÖÖ,ü ×¿ÖÖÖÖ ×¾Ö³ÖÖÖ

'Ö±ãüÖú×¾Ö,

,üÖÆãü,üß

,ü×Ö. -ÖÖ. 014/189

Ö²ÖÖ-ÖÖ"Öê -ÖÖÖ¾Ö ;ü²²Öß.¾ÖÖ,üß"μÖÖ ÖÖ"ÖÃÖã;ÖßÿÖÖ;Ö-

ÖÖ-ÖÖ×¾ÖÂÖμÖß -ÖÖ-Ö ¾Ö †¾Ö»ÖÖ²Ö-ÖÖ"ÖÖ †³μÖÖÃÖ.

³ÖÖÖ-1

†) ¿ÖÿÖú-μÖÖÖ"Öê 'ÖÖ×ÆüÿÖß-Ö;Öú

1. $\frac{1}{2} \cdot \frac{1}{3} = \frac{1}{6}$

□îú.ú('ÖÖê.)-----

2. $\frac{3}{4}\ddot{\text{O}}\mu\ddot{\text{O}} : \text{-----} \frac{3}{4}\ddot{\text{O}}\hat{\text{A}}\ddot{\text{O}}\text{:}$

3. x_i² : _____

4. $\frac{2\sqrt{3}}{4}$: _____ $\sqrt{2} \times \sqrt{2} =$ _____ $\frac{1}{2} \times \frac{1}{2} =$ _____

5. $\frac{1}{2} \cdot \frac{3}{4} \cdot \frac{5}{6} \cdot \frac{7}{8} \cdot \frac{9}{10} \cdot \frac{11}{12} \cdot \frac{13}{14} \cdot \frac{15}{16} \cdot \frac{17}{18} \cdot \frac{19}{20} \cdot \frac{21}{22} \cdot \frac{23}{24} \cdot \frac{25}{26} \cdot \frac{27}{28} \cdot \frac{29}{30} \cdot \frac{31}{32} \cdot \frac{33}{34} \cdot \frac{35}{36} \cdot \frac{37}{38} \cdot \frac{39}{40} \cdot \frac{41}{42} \cdot \frac{43}{44} \cdot \frac{45}{46} \cdot \frac{47}{48} \cdot \frac{49}{50} \cdot \frac{51}{52} \cdot \frac{53}{54} \cdot \frac{55}{56} \cdot \frac{57}{58} \cdot \frac{59}{60} \cdot \frac{61}{62} \cdot \frac{63}{64} \cdot \frac{65}{66} \cdot \frac{67}{68} \cdot \frac{69}{70} \cdot \frac{71}{72} \cdot \frac{73}{74} \cdot \frac{75}{76} \cdot \frac{77}{78} \cdot \frac{79}{80} \cdot \frac{81}{82} \cdot \frac{83}{84} \cdot \frac{85}{86} \cdot \frac{87}{88} \cdot \frac{89}{90} \cdot \frac{91}{92} \cdot \frac{93}{94} \cdot \frac{95}{96} \cdot \frac{97}{98} \cdot \frac{99}{100}$

«ú;Ö/x³/₄Ö³ÖŒÿÖ

7.2. $\tilde{a} \acute{u}^{\text{TM}} \tilde{a} \acute{O} \ddot{u} \ddot{u}^2 \ddot{O} \ddot{O} " \ddot{O} \ddot{J} ' \ddot{O} \ddot{O} \times \ddot{A} \ddot{u} \ddot{Y} \ddot{O} \ddot{J} :$

[illegible]

2Ö) ÄÖÖ'ÖÖ×•Öü ÄÖÆü³ÖÖ×ÖÖ¼Ö

†Ö-ÖÖÖ üü»μÖÖ ÄÖÖ'ÖÖ×•ÖüÄÖÖÄÖÖ“Öê-ÖüÖ×-ÖüÖ,üß †ÖÖ¼ÖÖ ÄÖüÄμÖ
†ÖÆüÖÖ ?

†.-ÖÖ	ÄÖÖ'ÖÖ×•Öü ÄÖÆü³ÖÖÖß¼Ö ÄÖÖÄÖÖ“ÖÖ ÖÖ-Ö×;Ö»Ö	ÄÖüÄμÖÖ¼Ö / -ÖüÖ×-ÖüÖ,üß		ÄÖÆü³ÖÖÖ/ÄÖ³ÖêÄÖ ^ÖÜÄÖÖß		
		ÆüÖêμ Ö	-ÖÖÆü ß	-ÖêÆü'Ö ß	ü-ÖßÖ,ü ß	ü-Öß“ Ö -ÖÖÆü ß
1	ÖÖ'Ö-ÖÖ“ÖÖμÖÖ					
2	-ÖÖ“ÖÖμÖÖÄÖ×'ÖÖß					
3	×•Ö»ÆüÖ -Ö×,üÄÖü					
4	ÄÖÆüüÖ,üßÄÖÖÖ,ü üÖ,üÖÖ-ÖÖ					
5	×¼Ö×¼Ö-Ö üÖμÖüÖ,üßÄÖÆüüÖ, üß ÄÖÖÄÖÖ					
6	×•Ö»ÆüÖÄÖÆüüÖ,üß ÖÖü					
7	Ö,êüüß ×¼Öüß ÄÖÖ'Ö					

8	¿ÖêŸÖß ^Ÿ-Ö®Ö ²ÖÖ•ÖÖ,ü ÃÖ×'ÖŸÖß					
9	¿ÖêŸÖÖü,üß ¿ÖÖÃ¿Ö-Ö 'ÖÖ“Ö					
10	¿ÖêŸÖÖü,üß ×¾Ö-ÖÖ-Ö 'ÖÖ»üôû					
11	³Ö•Ö-Öß 'ÖÖ»üôû					
12	‡ŸÖ,ü					

ü) •Ö×'Ö-Ö-ÖÖ,üÖÖ Öê¿Ö(ÆêüCE™ü,ü)

æüÖ •Ö'Öß- Ö	üÖμÖ'Ö“Ö ß -Ö»üßü	»ÖÖÖ¾Ö»üßÖÖ»Öß» Ö Öê¿Ö	“ÖÖ»Ö æ -Ö»üßü	×-Ö¾¾Öôû ×-ÖüÖÖÖ»Öß»Ö Öê¿Ö	
				×•Ö,üÖμÖŸÖ ß	²ÖÖÖÖμÖŸÖ ß

»ü) -Ößü -Ö-üŸŸÖß(†Ö-ÖÖ 'ÖÖÖ»Ö¾ÖÂÖá 'ÖêŸÖ»Öê»Öß ×-Öü¾ ¾Ö

ŸμÖÖ²ÖÖ²ÖŸÖ“Öß 'ÖÖ×ÆüŸÖß ÃÖÖÖÖÖ)

†.-Ö Ó	ÆÖüÖÖ'Ö/×-ÖüÖ“ Öê -ÖÖ¾Ö	¾ÖÖÖ	Öê¿Ö (ÆêüCE™ ü,ü)	²ÖÖÖμÖ ŸÖ/ ×•Ö,üÖμÖŸ	^Ÿ-ÖÖü- Ö ÜCE¾Ö/Æ	^Ÿ-Ö®Ö
-----------	----------------------------	------	-------------------------	----------------------------	-------------------------	--------

				Ö	êü.	
†.	Ö,üß-Ö x-Öêü					
1						
2						
3						
4						
²Ö.	,ü²²Öß x-Öêü					
1						
2						
3						
4						
ü.	^-/ÊüÖöüß x-Öêü					
1						
2						
3						
4						
»ü.	¾ÖÖÛÂÖü x-Öêü					
1						
2						
3						
4						
	êüÖ(†+²Ö+ü+»ü)					

±ü), ü²²Öß •¾ÖÖ, üß ²ÖÖ»Öß»Ö ²Öê;Ö

†.-ÖÖ.	¾ÖÖ²Ö	ÆêüCE™ü, ü (²Öê;Ö)		ˆY-ÖÖ¤ü-Ö (ÜCE¾Ö™ü»Ö)	
		2013-14	2014-15	2013-14	2014-2015
1	<’Ö-35-1				
2	±ãú»Öê ¾ÖÃÖã-ÖÖ				
3	±ãú»ÖêÃÖã×“Ö;ÖÖ				
4	±ãú»Öê †-Öã, üÖ-ÖÖ				
5	±ãú»Öê ,êü¾ÖYÖß				
6	±ãú»Öê ×“Ö;ÖÖ				
7	±ãú»Öê ’ÖÖ%oú»Öß				
8	±YÖ, ü				
9					

±Ö) ¾μÖ¾ÖÃÖÖμÖ :

†Ö-Ö²Ö ²üÖê²ÖYÖÖ ¾μÖ¾ÖÃÖÖμÖ ²ü, üYÖÖ?

†. ’Öã²μÖ ¾μÖ¾ÖÃÖÖμÖ -----²Ö. †-μÖ ¾μÖ¾ÖÃÖÖμÖ :-----

γ) ¾ÖÖÙÂÖµ Ÿ-Ö®Ö (γ-ÖµÖê)

†-ÖÖÖÖÄÖ 'ÖÖÖÖß»Ö ¾ÖÄÖá ×'ÖêûÖ»Öê»Öê Ÿ-Ö®Ö ÄÖÖÓÖÖ :

%ού) Ÿ-Ö®Ö :

†.µ.	¾µÖ¾ÖÄÖÖµÖÖÓ“Öß -ÖÖ¾Öê	'ÖāµÖ Ÿ-Ö®Ö	µāüµµÖ'Ö Ÿ-Ö®Ö	'ÖāµÖ + µāüµµÖ'Ö Ÿ-Ö®Ö (µāüÖ γ-ÖµÖê)
1	¿ÖêŸÖß			
2	µāüÖ-Ö¾µÖ¾ÖÄÖÖµÖ			
3	¿Öêêûß -ÖÖ»Ö-Ö			
4	-ÖÖêµ, üß			
5	¾µÖ¾ÖÄÖÖµÖ			
6	‡ŸÖ, ü			

ÄÖÓ-ÖÖÖÄÖÖ-Ö-Öê

²Ö) 'ÖÖ×ÆüŸÖß“ÖêÄ;ÖÖêŸÖ

-ÖÓ“ÖÄÖā;Öß ŸÖÖ;Ö-ÖÖ-ÖÖ²ÖÖ²ÖŸÖ 'ÖÖ×ÆüŸÖß ×'Öêû¾ÖÖµÖÖÄÖÖsüß †-ÖÖÖ

µüÖêÖÖÖüÖêÖŸµÖÖ ÄÖÖ-Ö-ÖÖÓ“ÖÖ ^ÖµÖÖêÖ µü, üŸÖÖ ?

†.- ÖÓ .	’ÖÖ×ÆüŸÖß“μ ÖÖ Ã;ÖÖêŸÖÖ“ÖÖ ŸÖ-Ö×;Ö»Ö	ÃÖÖ-ÖÖû ¼ÖÖ,Öü¼ÖÖ×,üŸÖê“ÖÖ ÖûÖ»Ö					
		†Öšü¼Ö» üμÖÖŸÖ ÖûμüÖ	-ÖÖ-Ö,ü¼Ö Ö»üμÖÖŸÖ ÖûμüÖ	’Ö×Æü-μ ÖÖŸÖ ÖûμüÖ	²ÖÖ,ü’ÖÖÆ üß	¼ÖÖÖù ÂÖÖû	Öû- Öß“ Ö -ÖÖ Æüß
†.	¼μÖÖêŸÖß;Ö: ÃÖÖ-ÖÖûÃÖ Ö-Ö-Öê						
1	×’Ö;Ö						
2	;Öê•ÖÖ,üß						
3	-ÖÖŸÖê¼ÖÖ‡ ÖÖû						
4	-ÖiÖÖŸÖ ;ÖêŸÖÖû,üß						
5	Ã£ÖÖ×-ÖÖû -ÖãœüÖ,üß						
6	Öéú×ÂÖ ÃÖê¼ÖÖÖéúü -Öi×ŸÖ×-Ö-Öß						
²Ö.	†ÖŕÖ“ÖÖ,üßÖ ú ¼ÖÖμÖÖÜêŸÖÖ						

	ú						
1	éú×ÂÖ $\times^{\frac{3}{4}}\ddot{O}^3\ddot{O}\ddot{O}\ddot{O}$ 'ÖÆüÖ,üÖÂ™ Òü ¿ÖÖÃÖ-Ö						
2	éú×ÂÖ ÃÖÆüÖμμÖú						
3	éú×ÂÖ ¯ÖμÖÔ $\frac{3}{4}$ ÖêÖ ú						
4	'ÖÖ,ü»Ö éú×ÂÖ †×¬ÖúÖ,üß						
5	ŸÖÖ»ÖãúÖ éú×ÂÖ †×¬ÖúÖ,üß						
6	^¬Ö $\times^{\frac{3}{4}}\ddot{O}^3\ddot{O}\ddot{O}\ddot{O}$ ßμÖ éú×ÂÖ †×¬ÖúÖ,üß						
7	×•Ö»ÆüÖ†×¬Ö ÖÖúéú×ÂÖ †×¬ÖúÖ,üß						
ú.	¬ÖÖ“ÖÖμÖŸÖ						

	ÃÖ×'ÖYÖß						
1	ÖÖÏÖ'ÖÃÖê¾ ÖÖú						
2	Öéú×ÂÖ ¾ÖÃYÖÖ,ü †×-ÖÖúÖ,üß						
3	Öéú×ÂÖ †×-ÖÖúÖ,üß						
4	ÖÖ™ü ¾ÖÖÖÃÖ †×-ÖÖúÖ,üß						
»ü.	ÖéúÛÂÖ ¾ÖªÖ-Ößêü /ÃÖÖ;ÖÖê-Ö- Ö Öéú!						
1	Öéú×ÂÖ ÃÖÆüÖµµÖÖú						
2	¾ÖÂÖµÖ ¾Ö;ÖêÂÖ-Ö						
3	Öéú×ÂÖ ;ÖÖÃ;Ö-Ö						
‡.	Öéú×ÂÖ ¾Ö- ÖÖ-Ö Öéú!ü						

1	éú×ÂÖ ÃÖÆüÖμμÖú						
2	×¾ÖÂÖμÖ ×¾Ö¿ÖêÂÖ–Ö						
3	ÖÏ'ÖãÖ, éú¾Æüßéú						
±Ö	×¾ÖÃÿÖÖ,ü ÃÖÓÖÖúÃÖ Ö–Ö–Öê						
1	Ö™ü “Ö“ÖÖÖ						
2	Ößú ÖÏÖÿμÖ×Öú						
3	×¿Ö¾ÖÖ,ü ±éú,üß						
4	¿ÖêÿÖú,üß ÖêôûÖ¾ÖÖ						
5	éú×ÂÖ ÖÏü¿ÖÖ–Ö						
6	¿ÖêÿÖú,üßÃ ÖÆü»Ö						
7	±ÿÖ,ü						

ÄÖÓ-ÖŒÔú ¾ÖÖ,Óü¾ÖÖ×,üŸÖê“ÖÖ ŒúÖŮ»Ö							
^	²Ö/ÆãüÄÖÓ-ÖŒ Ôú ÄÖÖ-Ö-Öê	œü,ü,üÖê Ö -ÖêÆü'Ö ß	†Öšü¾Ö»üμ ÖÖŸÖ “ÖÖ,ü ¾ÖêôûÖ	†Öšü¾Ö» üμÖÖŸÖ ŒúœüÖ	-ÖÓ-Ö,ü¾Ö Ö»üμÖÖŸÖ ŒúœüÖ	'Ö×Æü- μÖÖŸÖ ŒúœüÖ	Œú- Öß“ Ö -ÖÖ Æüß
†.	‡»ÖêĚ™ÖüÖ× -ÖŒú						
1	†ÖŒúÖ¿Ö¾Ö ÖŒÖß/ ,êü»üß†Öê						
2	œæü,üœü¿ÖÔ- Ö						
3	‡Ö™ü,ü-Öê™ ü						
4	ÄÖß»üß »üß¾Æüß»üß						
5	'ÖÖê²ÖÖ‡Ô»Ö						

1	$\frac{3}{4}\ddot{O}\acute{e}\phi\ddot{O}^-\ddot{O}_l\ddot{O}\hat{e}$					
2	$\text{?}\acute{e}\acute{u}\times\hat{A}\ddot{O}\times\frac{3}{4}\ddot{O}\tilde{A}\ddot{Y}\ddot{O}\ddot{O},\ddot{u}$ $\tilde{A}\ddot{O}\ddot{O}\times\acute{E}\ddot{u}\ddot{Y}_{\mu}\ddot{O}(\acute{E}\ddot{u}\tilde{A}\ddot{Y}\ddot{O}-$ $\acute{O}\rangle\ddot{u}\beta^-\ddot{O}\times_l\ddot{O}\text{?}\acute{u}\ddot{O})$					
3	$\text{?}\acute{e}\acute{u}\times\hat{A}\ddot{O}^-\ddot{O}\ddot{O}\times\tilde{A}\ddot{O}\text{?}\acute{e}\acute{u}$					
4	$\text{?}\acute{e}\acute{u}\times\hat{A}\ddot{O}^-\ddot{O}\ddot{O}\times\tilde{A}\ddot{O}\text{?}\acute{e}\acute{u}$ $\frac{3}{4}\ddot{O}\ddot{O}^-\ddot{O}\ddot{Y}\ddot{O}$ $\dagger\tilde{A}\ddot{O}\rangle_{\mu}\ddot{O}\ddot{O}\tilde{A}\ddot{O}$ $\text{?}\acute{u}\ddot{O}\acute{e}\text{?}\ddot{O}\ddot{Y}\ddot{O}\beta?$					
5	$\acute{A}\ddot{O}\beta\tilde{A}\ddot{O}\tilde{a}\text{?}\ddot{O}\beta$					
6	$\text{?}\acute{e}\acute{u}\times\hat{A}\ddot{O}\boxtimes\ddot{u}_{\zeta}\ddot{O}\hat{O}-\ddot{O}\beta$					
7	$\mp\ddot{Y}\ddot{O},\ddot{u}$					

3ÖÖÖ-2

-ÖÖ“ÖÃÖä;Öß YÖÖ;Ö-ÖÖ-ÖÖx¾ÖÃÖμÖß -ÖÖ-Ö ¾Ö †¾Ö»ÖÓ²Ö Öú,üÖμÖÖ“ÖÖ
YÖÖx;Ö»Ö
†. 'Öε †ÖxÖÖ •Ö»ÖÃÖÖ-ÖÖ,üÖÖ (-Öæ¾ÖÖ 'Ö;ÖÖÖÖYÖ)

†.-Ö Ó	YÖÖ;Ö- ÖÖ-ÖÖ“Öê -ÖÖ¾Ö	ÆüÖêμ Ö	-ÖÖÆ üß	-ÖÖ-Ö †ÃÖÖÖê		†¾Ö»ÖÓ²Ö-Ö		
				ÃÖÖ-ÖæÖ ÖÖ	-ÖÖÆ üß	-ÖæÖÖ Ö	†-ÖÖ¾Ö ™ü	-ÖÖÆ üß
1	-ÖÖÖÖÖ,üÖ Öß Öú,üYÖÖ ÖúÖ?							
2	Öãúôû¾ÖÖ Öß Öú,üYÖÖ ÖúÖ?							
3	¾ÖÖ±êú YÖμÖÖ,ü Öú,üYÖÖ ÖúÖ?							

²Ö. •Öx'Ö-Öß“μÖÖ -ÖÖÖú,üÖ-ÖãÃÖÖ,ü x¾ÖÖúxÃÖYÖ Öú»Öê»μÖÖ ¾ÖÖÖÖÖ“ÖÖ
¾ÖÖ-Ö,ü Öú,üYÖÖ ÖúÖ ?ÆüÖêμÖ / -ÖÖÆüß

2Ö. 1. •Ö×'Ö-Öß“ÖÖ -ÖïüÖ,ü ¾Ö ¾ÖÖÖÖÖÖ“Öê -ÖÖ-Ö

†.ü.	•Ö×'Ö-Öß“ÖÖ -ÖïüÖ,ü ¾Ö ×¿Ö±üÖ,ü¿ÖßŸÖ ¾ÖÖÖÖ	•Ö×'Ö-Öß-ÖãÄÖÖ,ü üãúšü»Öê ¾ÖÖÖÖ ¾ÖÖ-Ö,üÖ¾Öê? (^Ö,ü)	-ÖÖ-Ö	
			ÄÖÖ-ÖãÖÖ	-ÖÖÆüß
1	¾ÖÖ,üß (±ãú»Öê ¾ÖÄÖã-ÖÖ, ±ãú»Öê μÖ¿ÖÖêüÖ)			
2	'Ö-μÖ'Ö (±ãú»Öê ×“Ö¿ÖÖ, ±ãú»ÖêÄÖã×“Ö¿ÖÖ, ±ãú»Öê 'ÖÖ%ü»Öß, <Ö-35-1)			
3	Æü»Öüß (±ãú»Öê †-Öã,üÖ-ÖÖ, ×ÄÖ»ÖêCE¿Ö-Ö -3)			

2Ö. 2. •Ö×'Ö-Öß“μÖÖ -ÖïüÖ,üÖ-ÖãÄÖÖ,ü •¾ÖÖ,üß“ÖÖ ¾ÖÖÖÖÖÖ“ÖÖ ¾ÖÖ-Ö,ü

†.ü.	•Ö×'Ö-Öß“ÖÖ -ÖïüÖ,ü ¾Ö ×¿Ö±üÖ,ü¿ÖßŸÖ ¾ÖÖÖÖ	†Ö-ÖÖ üÖãÖŸÖê ¾ÖÖÖÖ ¾ÖÖ-Ö,üŸÖÖ (^Ö,ü)	†¾Ö»ÖÖ²Ö-Ö		
			-ÖæÖÖ	†-ÖÖ¾Ö™ü	-ÖÖÆüß
1	¾ÖÖ,üß (±ãú»Öê ¾ÖÄÖã-ÖÖ, ±ãú»Öê				

	μÖ¿ÖÖêϣüÖ)				
2	'Ö¬μÖ'Ö (±ãú»Öê ×“Ö¿ÖÖ, ±ãú»ÖêÃÖã×“Ö¿ÖÖ, ±ãú»Öê 'ÖÖ%οú»Öß, ‹Ö-35-1)				
3	Æü»Öϣ (±ãú»Öê †-Öã,üÖ¬ÖÖ, ×ÃÖ»ÖêƐ¿Ö-Ö -3)				

ü. -Öê,üÖß“Öß¾Öêð

¾ÖÖ,üß“Öß-Öê,üÖß ü-Öß ü,üYÖÖ?

†.-ÖÖ	-Öê,üÖß	^Ö,ü	-ÖÖ-Ö		†¾Ö»ÖÖ²Ö-Ö		
			ÄÖÖ-ÖæÖÖ	-ÖÖ/Æüß	-ÖæÖÖ	†-ÖÖ¾Ö™ü	-ÖÖ/Æüß
1	-Öê,üÖß ü-Öß ü,üÖ¾Öß?						
2	†Ö-ÖÖ -Öê,üÖß ü-Öß ü,üYÖÖ?						

ü. ²Öß·Ö-Öï×üÖÖ :

†.- ÖÖ	²Öß·Ö-Öï×üÖÖ (×¿Ö±üÖ,üÄÖ) ÖÖ-Öü 3 Öïð'Ö + 25 Öïð'Ö †ð— ÖÖ™üÖê²ÖðCE™ü, ü	^Ö,ü	-ÖÖ-Ö		†¾Ö»ÖÖ²Ö-Ö		
			ÄÖÖ- Öæ ÖÖ	-ÖÖ Æü ß	-Öæ ÖÖ	†-Ö Ö¾Ö ™ü	-ÖÖ/Æ üß
1	²Öß·Ö -Öï×üÖÖüÄÖ»Ö						

	ß ů,üÖ¾Öß?						
2	†Ö-ÖÖ ů ů,üÖÖ“Öß ů,üŸÖÖ?						

‡. ·¾ÖÖ,üß“μÖÖ ,üÖε-ÖÖ“Öß ÅÖÖμÖÖ

†.-Ö ó.	ůůÖ'Öê	^Ö, ü	-ÖÖ-Ö		†¾Ö»ÖÖ²Ö-Ö		
			ÅÖÖ-Öæ ÖÖ	-ÖÖ/Æ üß	-ÖæÖ ô	†-ÖÖ¾Ö ™ü	-ÖÖ/Æ üß
1	-Öê,üÖß“Öê †ÖŸÖ,ü ×ůŸÖß†ÅÖÖ¾Öê ?						
2	†Ö-ÖÖ ×ůŸÖß †ÖŸÖ,üÖ¾Ö,ü ů,üŸÖÖ?						
3	×²ÖμÖÖÖê ×ůŸÖß ¾ÖÖ-Ö,üÖ¾Öê ?(ÆêüCE™,üßü)						
4	ŸÖã'/Æüß ×ůŸÖß ¾ÖÖ-Ö,üŸÖÖ?(ÆêüCE™ ü,üß)						
5	×¾Ö,üôůÖß ů,üÖ¾Öß ůÖ?						
6	†Ö-ÖÖ ×¾Ö,üôůÖß						

	𐌆𐌿,üŸÖÖ 𐌆𐌿Ö?						
--	--------------	--	--	--	--	--	--

‡Ô. ¾ÖÖ-ÖÃÖÖ ×™üü¾Öæ-Ö šêü¾ÖμÖÖ“Öê YÖÖjÖ

¾ÖÖ-ÖÃÖÖ ×™üü¾Öæ-Ö šêü¾ÖμÖÖÃÖÖšüß †Ö“”ûÖœü-ÖÖ“ÖÖ ¾ÖÖ-Ö,ü üü,üYÖÖ
üÖ?

-Öj-Ö ü	^Ö,ü	-ÖÖ-Ö		†¾Ö»ÖÖ²Ö-Ö		
		ÃÖÓ	-ÖÖ	-Öæ	†-Ö	-ÖÖ
		-Öæ	Æüß	ÖÖ	Ö¾Ö	Æüß
		ÖÖ			™ü	
¾ÖÖ-ÖÃÖÖ ×™üü¾Ö¾ÖμÖÖ ÃÖÖšüß üÖêÖYÖê †Ö“”ûÖœü-Ö ¾ÖÖ-Ö,üYÖÖYÖ?						
¾ÖÖ-ÖÃÖÖ ×™üü¾Ö¾ÖμÖÖ ÃÖÖšüßYÖã'Æüß üÖμÖ üü,üYÖÖ?						

^: †ÖÖYÖ,ü'ÖjÖÖÖYÖ

üÖêêû-ÖÖß, ÖÖã,ü-ÖÖß üü,üYÖÖ üÖ?

YÖÖjÖ-	ÆüÖ	-ÖÖÆü	-ÖÖ-Ö		†¾Ö»ÖÖ²Ö-Ö		
			ÃÖÓ-ÖæÖ	-ÖÖÆü	-ÖæÖ	†-ÖÖ¾Ö™	-ÖÖÆü
ÖÖ-Ö	ê	ß					

			ô	ß	ô	ü	ß
üÖêû-ÖÖ							
ß							
-Ö×Æü»Öß							
æüÄÖ,üß							
×YÖÄÖ,üß							
Öä,ü-ÖÖß							
1 Øü¾ÖÖ 2							
¾ÖêûÖ							

%ou. -ÖÖÖß ¾µ¾ÖÄ£ÖÖ-Ö-Ö

×-ÖüÖ»ÖÖ -ÖÖÖß æüYÖÖ üÖ ?

YÖjÖ- ÖÖ-Ö	ÆüÖê	-ÖÖÆüß	-ÖÖ-Ö		†¾Ö»ÖÖ²Ö-Ö		
			ÄÖÖ-ÖæÖ	-ÖÖÆüß	-ÖæÖÖ	†-ÖÖ¾Ö™ü	-ÖÖÆüß
-ÖÖÖß							
æüÖê							
ü							
¾ÖêûÖ							
üÖê-Ö							
¾ÖêûÖ							

Æü. üÜY-ü ÖYÖ ¾µ¾ÖÄ£ÖÖ-Ö-Ö :

×-ÖüÖÖ-ÖÖ ÖYÖê æüYÖÖ üÖ ?

†.-Ö Ó.	ÖÖÖÖ“ÖÖ -ÖüÖ,ü	^Ö,ü	-ÖÖ-Ö		†¾Ö»ÖÖ²Ö-Ö		
			ÄÖÖ-	-ÖÖ	-Öæ	†-Ö	-ÖÖ
			Öæ	Æü	ÖÖ	Ö¾Ö	Æü
			ÖÖ	ß		™ü	ß
1	¿ÖæÖÖÖ ×üYÖß ¾ÖÖ-Ö,üÖ¾Öê? (ÆêüCE™ü,üß)						
2	YÖã'Æüß ¿ÖæÖÖÖÖ ×üYÖß ¾ÖÖ-Ö,üYÖÖ? (ÆêüCE™ü,üß)						
3	,üÖÄÖÖµÖ×-Öü ÖYÖê ×üYÖß ¾ÖÖ-Ö,üÖ¾ÖßY Ö ? (×¿Ö±üÖ,üÄÖ ×ü./Æêü.) 50:50:00 (-Ö¡Ö:Ä±ãü,üü:-Ö Ö»ÖÖ¿Ö)						
4	,üÖÄÖÖµÖ×-Öü						

	2ÖYÖéYÖã'Æüß ×2úYÖß ¾ÖÖ-Ö,üYÖÖ?					
--	---------------------------------------	--	--	--	--	--

•Ö. 2úÖüY'Ö2ú-Öß2úÄÖÓ,ü2Ö2Ö:

×2ú>ü-ÖÖ;Ö2ú ¾Ö ,üÖé2Ö-ÖÖ;Ö2ú ¾ÖÖ-Ö,üYÖÖ 2úÖ ?

†.-Ö Ó.	ÄÖÖ-Ö-Öé	^Ö,ü	-ÖÖ-Ö		†¾Ö»ÖÖ²Ö-Ö		
			ÄÖÖ- Öæ2 ÖÖ	-ÖÖ Æüß	-Öæ 2Ö Ö	†-ÖÖ ¾Ö™ ü	-ÖÖ Æü ß
1	2ÖÖé>ü'ÖÖ;Öß						
1	×2ú>üü-ÖÖ;Ö2ú×2 üYÖß ¾ÖÖ-Ö,üÖ¾Öé?						
2	YÖã'Æüß ×2ú>ü-ÖÖ;Ö2ú×2ú YÖß ¾ÖÖ-Ö,üYÖÖ?						
2	2ÖÖé>ü×2ú>üÖ						
1	×2ú>üü-ÖÖ;Ö2ú ×2úYÖß ¾ÖÖ-Ö,üÖ¾Öé?						

2	$\ddot{Y}\ddot{O}\tilde{a}'\text{Æ}\ddot{u}\beta$ $\times\text{ü}\text{ü}-\ddot{O}\ddot{O}_{\xi}\ddot{O}\text{ü}\times\text{ü}$ $\ddot{Y}\ddot{O}\beta$ $\frac{3}{4}\ddot{O}\ddot{O}-\ddot{O},\ddot{u}\ddot{Y}\ddot{O}\ddot{O}?$						
3	$\text{ü}\ddot{O}\ddot{O}\beta$						
1	$,\ddot{u}\ddot{O}\ddot{O}-\ddot{O}\ddot{O}_{\xi}\ddot{O}\text{ü}$ $\times\text{ü}\ddot{Y}\ddot{O}\beta$ $\frac{3}{4}\ddot{O}\ddot{O}-\ddot{O},\ddot{u}\ddot{O}\frac{3}{4}\ddot{O}\hat{e}?$						
2	$\ddot{Y}\ddot{O}\tilde{a}'\text{Æ}\ddot{u}\beta$ $,\ddot{u}\ddot{O}\ddot{O}-\ddot{O}\ddot{O}_{\xi}\ddot{O}\text{ü}$ $\times\text{ü}\ddot{Y}\ddot{O}\beta$ $\frac{3}{4}\ddot{O}\ddot{O}-\ddot{O},\ddot{u}\ddot{Y}\ddot{O}\ddot{O}?$						
4	$\ddot{O}\text{ü}\ddot{O}\text{ü}\ddot{O}\ddot{O}$						
1	$,\ddot{u}\ddot{O}\ddot{O}-\ddot{O}\ddot{O}_{\xi}\ddot{O}\text{ü}\times$ $\text{ü}\ddot{Y}\ddot{O}\beta$ $\frac{3}{4}\ddot{O}\ddot{O}-\ddot{O},\ddot{u}\ddot{O}\frac{3}{4}\ddot{O}\hat{e}?$						
2	$\ddot{Y}\ddot{O}\tilde{a}'\text{Æ}\ddot{u}\beta$ $,\ddot{u}\ddot{O}\ddot{O}-\ddot{O}\ddot{O}_{\xi}\ddot{O}\text{ü}$ $\times\text{ü}\ddot{Y}\ddot{O}\beta$ $\frac{3}{4}\ddot{O}\ddot{O}-\ddot{O},\ddot{u}\ddot{Y}\ddot{O}\ddot{O}?$						
3	$\ddot{Y}\ddot{O},\ddot{u}$						

,ü²²Öß •¾ÖÖ,üß“μÖÖ ^ÿ-ÖÖϣü-ÖÖ’Ö-Öß»Ö †ü“ÖÖÖß

†.-ÖÖ.	†ü“ÖÖÖß	ÃÖã“Öx¾Ö»Öê»Öê ^ÖÖμÖ
†.	ÿÖÖÖ×;ÖÖü †ü“ÖÖÖß	
1	ÃÖã-ÖÖ×,üÿÖ †¾Ö•ÖÖ,üÖÖ“Öß ’ÖÖ×ÆüÿÖß ×’ÖêüÿÖ -ÖÖÆüß	
2	,ü ²² Öß •¾ÖÖ,üß“μÖÖ -ÖÖ“ÖÃÖã;Öß ÿÖÖ;Ö-ÖÖ-ÖÖ“Öß ’ÖÖ×ÆüÿÖß ×’ÖêüÿÖ -ÖÖÆüß	
3		
²Ö.	†ÖÛ£ÖÖü †ü“ÖÖÖß	
1	-Öã,êüÃÖê -ÖîÃÖê ^Ö»Ö²-Ö -ÖÖÆüßÿÖ	
2	,üÖÃÖÖμÖ×-ÖÖü ÖÖÿÖÖÖ“ÖÖ ϣü,ü •ÖÖÃÿÖ	
3	ÃÖã-ÖÖ×,üÿÖ ×²ÖμÖÖÖÖÖ“ÖÖ ϣü,ü •ÖÖÃÿÖ	

3	'Ö•Öã,üÖÖ“Öß ÃÖ'ÖÃμÖÖ †ÖÆêü	
4	-Ö²μÖÖÖ“Öß †>ü“Ö²Ö (²ÖÖŸÖÖŸÖ)	

VITA

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in

AGRICULTURAL EXTENSION

2016

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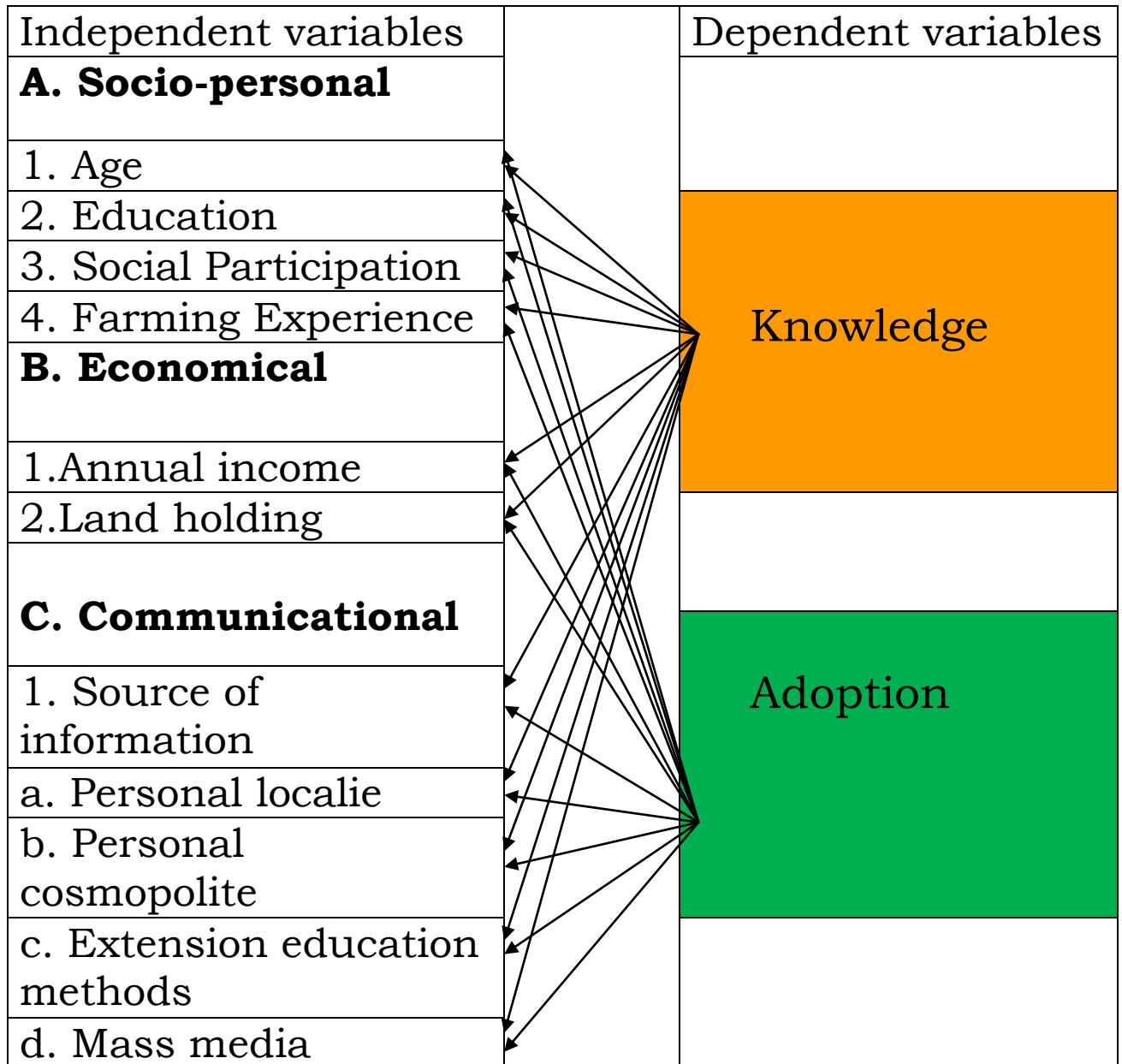


Fig. 1: Conceptual model of the study

→ : Showing correlation